44

Arrow, K.J. and W.M. Capron, "Dynamic Shortages and Price Rises: The Engineer - Scientist Case", Quarterly Journal of Economics, May 1959, pp. 292-308.

Research Questions/Hypotheses

During the 1950s, several authors were documenting evidence of an apparent shortage in the market for scientists and engineers, and were calling for some form of government intervention in the face of what they perceived as market imperfections. Arrow and Capron reject this interpretation of market failure and seek a model which would explain the observed "shortage" in terms of a dynamic, optimizing framework. In doing this, they shed some light on what we mean when we use the word "shortage" when referring to a labor market.

Research Approach

The research approach is to devise a simple, theoretical model which will explain the dynamic characteristics of price and quantity adjustment in the face of excess demand or supply. The entire model is elegantly developed in two lengthy footnotes. It incorporates very simple demand and supply equations and a price adjustment mechanism such that the movement of price (wage) over time is directly proportional to the deviation between demand and supply. The research is purely theoretical in that the authors do not attempt to test their hypothesis with data. Rather, they formulate a simple model which helps to explain observed phenomena.

Findings

Using their model, the authors find that a shortage can be sustained indefinitely if there is ever-increasing demand for engineering and scientific services, which is outstripping the automatic equilibrating mechanism of the market. They argue that in the 1950s there was a surge in demand for scientists and engineers as private and public spending on research and development increased, hence creating what they call a "dynamic shortage". The steadily rising demand is combined with two other characteristics of this labor market to yield a dynamic shortage. First, the elasticity of supply of scientists and engineers to variations in the wage may be expected to be slow due to the time required to train new personnel. Secondly, the speed with which wages adjust to correct an excess demand may be slow in the scientist - engineer market relative to others. Some possible reasons for this are the prevalence of long-term contracts, the influence of heterogeneity of the market in slowing the diffusion of information, and the dominance of a relatively small number of firms in research and development.

An important implication of this work for the field of economics is the authors' attempt to clarify what is meant by a shortage. Basically they call for people to specify more clearly what they mean when they use the term. Specifically, at what price are you referring to? An increase in demand will create a shortage at the initial price, but there exists some price at which the firm can redress its perceived shortage. The unwillingness for firms to pay the market-clearing wage and/or the satisfaction of workers with the status quo are necessary conditions for the presence of a labor shortage in the absence of rapidly increasing demand.

Appropriateness of Technique

Since the paper has no empirical content, there is little to say under this heading. In some sense, their technique is the most elegant of all in economics. They took a question and came up with a simple yet plausible mathematical model to answer it.

Reliability of Findings

The findings are as reliable as can be expected given the simplicity of the model. Again, not much more can be said here due to the nature of the research.

Braddock, Douglas, "The Oversupply of Ph.D.'s to Continue Through 1985", Monthly Labor Review, Bureau of Labor Statistics, U.S. Dept. of Labor, October, 1978.

Research Questions/Hypotheses

This paper uses Bureau of Labor Statistics (BLS) procedures to project the supply and demand of Ph.D.s in all fields out to 1985.

Research Approach

This article's main purpose is to report the results of BLS research into the supply and demand for doctorate manpower. It is not a technical article. The methodology is described in its footnotes and is also the same as that used in the Ph.D. manpower projections (BLS Bulletin 1860) done by the BLS in 1975. The methodology will be the main focus of this abstract.

Supply projections are borrowed from the National Center for Education Statistics. Projected Ph.D. supply is composed of the number of Ph.D. degrees expected to be granted over the 1976 to 1985 period, less attrition due to death and retirement plus net in-migration. Projections to a few years in the future can be made quite accurately because those who will receive degrees are already in graduate programs and reliable data is available. As far as I can tell, these projections are based on demographic rather than economic factors. That is, the college age population - who are already born - are expected to attend graduate school in increasing numbers and proportions than what occurred in the 1960s. The increasing proportions are expected to follow recent trends.

The author does bring up one interesting point with regard to how one should think about doctoral supply. He shows that an increasing number of Ph.D.s are taking jobs which are "untraditional" given their level of training. Thus, many are underemployed in terms of historical standards. It is reasonable to assume that at least some of these underemployed scholars will compete for the new traditional Ph.D. jobs, thus exacerbating any excess supply.

The demand side of the equation is handled somewhat more rigorously. It appears that what the BLS does is to observe past trends of the ratios of the number of Ph.D.s by field to total employment in those fields and extrapolate them into the future. They then take their projections of the total labor force by field and multiply these by the ratios to get the requirements for Ph.D. labor. It turns out that Ph.D.s have a lower death and retirement rate than the workforce as a whole so the estimates are revised downward accordingly. Lower death and retirement

rates mean less replacement needs due to attrition.

Findings

In general, the results indicate that the situation for new Ph.D.s over the 1976-85 period will be roughly the same as existed over the 1970-76 period. Doctorates will continue to be pushed into occupations which have traditionally been held by less educated workers. The only exception is engineering, where the percent of new Ph.D.s going to nontraditional jobs is expected to decline. Depending on how many of the existing doctorates engaged in nontraditional work decide to compete for the new traditional jobs, the percent of new supply being forced into nontraditional employment will be between 40% and 65%, representing best- and worst-case scenarios respectively.

Over the 1976-85 period, the projected new supply of Ph.D.s was 323,000 while the number of new openings for traditional jobs (created by growth plus attrition) was projected to be 192,800. The hardest hit sectors are physics, mathematics, arts and humanities, education, and business and commerce.

Appropriateness of Technique

These projections are rough and there seems to be no feedback mechanism in place which has the potential of redressing the projected imbalances. The model is rather eclectic in that it uses NCES forecasts of supply and their own extrapolations of demand.

It is valuable to have the projections disaggregated as they are, to the credit of the BLS.

Reliability of Findings

The BLS has stopped making Ph.D. projections because they believe it is difficult to develop reliable findings. It is obviously a very difficult undertaking which is frought with problems ranging from data to sufficient theoretical underpinnings. The BLS model lacks a market response machanism by which students may react to adverse labor market conditions. In addition, perhaps the BLS could have reconsidered the definition of "traditional employment", the benchmark on which the article's conclusions are based. It is quite possible that the definition is rapidly becoming outdated as a generally more educated population emerges. Nevertheless, the point that underemployed Ph.D.s may seek newer and better jobs, thus competing with the fresh Ph.D.s, poses an interesting problem and suggests that other measures of supply in the literature may be understating true labor supply conditions.

48

Bureau of Labor Statistics, Occupational Projections and Training Data: A Statistical and Research Supplement to the 1986-87 Occupational Outlook Handbook. (BLS Bulletin 2251) (Washington, D.C. 20402, Superintendent of Documents, U.S. Government Printing Office), April 1986.

Research Questions/Hypotheses

The Bureau of Labor Statistics regularly produces comprehensive employment and occupational projections of the general labor force. A rough sketch of the projection procedure is outlined in the above publication and summarized in this abstract.

Research Approach

The projection model is large, covering the national economy and treating the rest of the world as exogenous. Assumptions are made concerning the population, fiscal and monetary policy, foreign economic conditions, energy, and other factors. Population growth is a major determinant of the supply side of the labor force. Fiscal and monetary policy will have influence on economic growth and hence the creation of new jobs. Foreign economic conditions affect our exports and hence domestic production. Energy affects production costs and hence prices and wages, thus influencing labor demand.

Three sets of assumptions are made about the future path of the various exogenous variables - for moderate, low, and high economic growth and these figures are fed into an economic model. The one most recently used is the Wharton Econometrics model. Population projections are borrowed from the Bureau of the Census.

To obtain general labor force projections, The BLS applies its projections of participation rates to the population projections of the Census Bureau. This is done for several age, sex, and racial groups. It seems as though the projected participation rates are basically extrapolations of past trends, adjusted for anticipated changes in net migration.

Industrial output projections are then obtained from an input-ouput model of the Dept. of Commerce which is applied to the aggregate projections that have been derived from the macro model. From here, the employment necessary to achieve these output levels is calculated, based on past output-labor ratios adjusted for technological change and other factors.

Once these industry projections are made, they are applied to an industry-occupation matrix to determine the occupational demand for workers. The data used in constructing this matrix is collected by the BLS with the help of state employment agencies.

This matrix effectively converts the industry projections of total employment demand into occupational ones (think of the operation of using the dollar-sterling exchange rate to convert U.S. dollars to pounds sterling).

Appropriateness of Technique

Obviously this method of projections involves a lot of work and cooperation from a wide range of experts. It would be appealing to a macroeconomist who tends to be more concerned with the economy as a whole. The BLS will give him projections of labor supply, and demand for the various occupational categories and industries. But the microeconomist would want to know if the workers will allocate themselves into the new openings, and if so, will they be qualified? What signals did they receive which persuaded them to pursue training for the job, and are they being employed to their full potential? The BLS does not seem capable of answering these and other important behavioral questions, which are the most important in deciding on policy responses.

Dauffenbach, Robert C. and Jack Fiorito, "Projections of Supply of Scientists and Engineers to Meet Defense and Nondefense Requirements, 1981 - 87: A Report to the National Science Foundation", Division of Science Resource Studies, National Science Foundation, April 1983.

Research Questions/Hypotheses

In this report, the authors build on their earlier work to generate some projections of scientific and engineering (S/E) manpower supply through 1987. The projections are done with various demand scenarios for economic growth and defense spending to test the sensitivity of their model. Thus, demand is treated exogenously and the projections are generated by a model of supply which encompasses three dynamic aspects of labor supply: namely flows of new entrants into S/E occupations, flows of experienced workers into, out of, and among S/E occupations, and international flows of S/E workers. Thus, in the process of generating the projections, the authors empirically estimate a general model of the S/E labor market. This is a major contribution as most work in this area has focussed on only one of the three sources of S/E manpower.

Research Approach

The majority of the paper is devoted to the estimation of the behavioral relations which explain the variation in the three flow variables. Within these three major components are several subcomponents, equations for which are estimated in turn, with varying econometric techniques. The following diagram explains the relationships between the major components and their corresponding subcomponents.

new entrants	degree attainment curriculum choice labor force entry occupational entry
experienced workers	occupational mobility attrition
international flows	immigration emmigration

Various researchers have attempted to estimate behavioral relations which explain one or more of these subcomponents but none that I know of have estimated and performed projections of the group as a whole. This is the significance of the present research.

Let's begin by looking at the new entrants component. The authors consider the decision to enroll in college as being independent

of curriculum choice, a view they have expressed convincingly in previous work. Degree attainments are said to depend positively on family income and lagged attainments. The dependent variable (both current and lagged) is expressed as a rate rather than in level form. It was found that when degree attainments were expressed as levels, the demographic effects tended to dominate the regressions and thus left little room for economic responses. Separate regressions were done for each of the three degree levels of baccalaureate, masters, and doctorate for male and female. Thus, six separate regressions were performed. Degree attainment rates were defined in the following way: for baccalaureates in year t, it was number of degrees conferred as a proportion of the number of 18 year- olds in year t-4; for masters and doctorate cohorts, degree attainment rates were defined as degrees conferred at these levels as a proportion of baccalaureates two and four years earlier, respectively. While these are not pure attainment rates, they are probably fairly close estimates. The attainment equations were estimated using the Cochrane-Orcutt technique, which addresses the problem of autocorrelation in the data.

The time period covered was 1951 to 1980. Data for degree conferrals were obtained from the National Center for Education Statistics. Median family income data was constructed with the use of the U.S. Census Current Population Reports.

The curriculum choice submodel postulates that degree conferrals in a particular field reflect economic conditions in that field, probably with a lag. Students observe labor market conditions such as salaries and job placements in time t, and the effects of their joint decisions are felt in time t+4. In previous work, Dauffenbach and Fiorito have stressed the importance of nonpecuniary determinants of curriculum choice but here they have abandoned that due to insignificant results. It turned out that salaries did not work well either so an individual curriculum choice equation simply consists of degree conferrals in a field as a proportion of total degrees at a given level regressed on a measure of job share. Job share in a field is defined as the number of jobs in that field relative to the total number of professional and technical jobs in the economy. The data was not separated by sex because of the perverse results generated by the female cohort. The data consisted of a pooled time-series cross-sectional base covering 1968-81 and the 21 categories of S/Es. This made for a data set approaching 300 observations. Field-specific dummy variables were employed to separate out the differential effects of the fields and isolate the effects of the job share variable. It turned out that ordinary least squares estimation yielded the best results. One equation was estimated for each of the three degree levels of baccalaureates, masters, and doctorates.

Data sources: degree conferrals from National Center for

Education Statistics: job shares derived from U.S. Dept. of Labor and NSF data.

Upon completion of the bachelors or masters degrees, not all recipients enter the labor market: some opt for further studies. The purpose of the labor force entry equation is to adjust for this alternative behavior. A causal model was not attempted here. Rather, the authors updated previous work where they calculated labor force entry propensities at the various degree levels. These rates of labor force entry had been relatively stable over the recent past so it was deemed unnecessary and fruitless to try to explain their behavior. It is assumed that the propensity of Ph.D.s to enter the labor force upon degree completion is 100%. Estimates for all fields not disaggregated by sex were done using NSF surveys of recent college graduates. There were too few female observations for some disciplines to carry out separate estimates by sex. The authors are not clear as to the methodology used in deriving these estimates. It seems as though averages are calculated from NSF survey data. The reader is referred to earlier work.

The occupational entry subcomponent explains the school-to-work transition of college graduates. Is there a behavioral mechanism which allocates graduates into certain fields? The specification is similar to previous work by Fiorito on the school-to-work transition. The probability that a student from a certain course of study enters any given field upon graduation is viewed as a function of labor market conditions in that field and the similarity of the coursework to the required skills of the occupation. Labor market conditions or "demands" in this framework are measured by changes in occupational employment in the "destination" occupation. To see how these variables interact, consider petroleum engineering. If there was strong demand for this specialty, then we would expect to see a high propensity of petroleum engineering graduates entering that field as a career. Furthermore, we would not expect to see very many economics majors taking jobs in the petroleum engineering field because very little if any of the coursework would overlap.

The dependent variable is the probability of entering a specific occupation given the person's major. A separate equation was estimated for bachelors and masters recipients. There is also a set of dummy variables which allow for engineering, computer science and mathematics, life and physical sciences, and social sciences each to have special group effects on the likelihood that majors are employed in their own field of college study. OLS estimation seemed to perform better than GLS perhaps due to the nature of the sample. The estimation was done for bachelors and masters cohorts who received their degree in the 1976-79 period. The data comes from NSF surveys. Efforts to disaggregate the estimation by sex proved difficult due to the small number of females in some S/E fields.

Now let's consider experienced workers. As previously mentioned, this category is divided into two subcomponents of occupational mobility and attrition. Occupational mobility is not an easy variable to explain but the authors make a commendable effort. They estimate a reduced form equation which expresses two separate measures of mobility (described below) as a function of the proportion of stayers in an occupation, the amount of new entrants, the percent of the occupation which is female, and the average years of education of people in the occupation. Let's consider these relationships in a little more detail. If there is a high degree of inertia in an occupation along with a high rate of new entry, one would expect that the degree of mobility into the occupation would be low. That is, any excess demand in the field is being accomodated by new entrants and a lot of "stayers". Furthermore, in professions such as nursing where there is a high proportion of females who are juggling domestic and professional careers, one would expect to see a lot of mobility as women leave and reenter the labor force. Finally, in careers which demand a high level of vocational-specific training or education, we would expect to see relatively low rates of mobility.

Two mobility equations are estimated which reflect two specifications of the dependent variable. Broad S/E fields are distinguished by different intercepts generated by a set of dummy variables. Both equations were used in the projections. One such specification was in-mobility, defined as the number of people transferring into an occupation from other occupations as a proportion of the total number of employees in that occupation. This equation was estimated using ordinary least squares and the dependent variable was expressed in log form. This is called a semi-log model and its purpose is to constrain the dependent variable to be positive (because the natural log of a negative number is undefined). The alternative specification used net-mobility as the dependent variable and was also estimated with ordinary least squares. The rate of net-mobility is the rate of in-mobility minus the rate of out-mobility for each occupation. Here the dependent variable was not expressed in log form because the possibility of negative values could not be ruled out.

Data on mobility was available from the Current Population Survey for 1973, 1978, and 1981 for 26 occupational categories yielding 78 observations on the dependent variable. The same data source was used for the independent variables of the proportion of stayers, the amount of new entrants, the proportion of females in the occupation, and the educational attainment of people in the occupation.

The attrition component is composed of deaths and retirements. Death rates were taken from BLS Special Labor Force No. 187, Length of Working Life of Men and Women, 1970. Retirement rates

were estimated as a function of age and education for persons over fifty years of age. Logit estimation was used. Data on retirement rates were obtained from NSF's Professional Manpower Surveys.

Now let's consider international flows of scientists and engineers. Due to the absence of data on emigration, this component was omitted and the issues of immigration and participation by foreign nationals in U.S.higher education were considered under the international heading. The rate of immigration is probably quite responsive to U.S. immigration policy and economic conditions in the country of origin. Data on the latter are elusive so the model estimates immigration as a function of U.S. occupational employment changes, controlling for a temporary liberalization of immigration requirements in the 1967-72 period. The dependent variable is the number of S/E immigrants by occupation and over time. One equation is estimated with a complete set of S/E field-specific dummy variables. The equation was estimated using the Cochrane-Orcutt technique with data from the INS's Annual Reports.

The authors did not attempt any formal modelling of the foreign student participation. They calculated foreign participation rates which they used to adjust the degree conferral numbers in the simulations. Foreign participation rates are expressed as the percentage of graduates by field and level that are foreign nationals. Degree conferrals will overstate domestic labor market activity if many of the degrees are awarded to foreigners who return to their countries.

Simulations were then done on the entire model under various demand scenarios.

Findings

In the course of the research, it seemed that the authors adjusted the model to fit the data, and the results are therefore very straight-forward and will not be repeated here. There were no surprises in the estimated coefficients. Since I have not said much about the projections, I will report those results in this section. Projections were done out to 1987 and it was found that surplus conditions dominate in S/E occupations. Surpluses are generally large for the natural and physical sciences but particularly large for the social sciences. In some occupations such as aeronautical engineering and computer science, while a shortage situation was not observed, large quantities of in-migration were. The authors point out that this could be a shortage according to some definitions. In-mobility from other fields can help redress a short run imbalance (excess demand) but it cannot persist indefinitely while at the same time keeping quality constant.

Appropriateness of Technique

A wide variety of econometric techniques was used in this research, which makes it difficult to comment on. In most cases where the dependent variable was constrained to the unit interval (i.e. it was expressed as a fraction), the authors converted the data to logits. The reason for this is to ensure that predicted values outside the unit interval are not permitted. This is particularly important when coefficient values are to be used for simulations.

They were particularly imaginative in finding data for some of their variables and indeed one of the major contributions of the research was the generation of new and updated data for variables such as mobility and foreign student participation rates.

Reliability of Findings

As always, the results are only as good as the data and the authors acknowledge that in this case data is a poignant problem. The problem most often cited is the fact that the NSF surveys cover only the S/E labor market and are therefore not necessarily representative of the entire labor market. I do not think this is a problem if one is willing to assume that the S/E market is independent from the rest of the technical and professional manpower market. This is probably a reasonable assumption, due to the high levels of expertise needed for most S/E jobs.

The authors acknowledge that the issue of quality is important and not addressed due to obvious data difficulties. In-mobility into a field cannot persist indefinitely while holding quality constant.

Falaris, E.M., "A Model of Occupational Choice", in T. Paul Schultz and Kenneth I. Wolpin, Eds., Research in Population Economics, Vol. 5, JAI Press: Greenwich, Conn., 1984, pp. 289 - 307.

Research Questions/Hypotheses

The purpose of this paper is to estimate a model of occupational choice with a nested logit specification. Other work in this area has used the more restrictive conditional logit model or the computationally taxing multinomial logit model. The principal hypothesis to be tested is whether occupational choice can be explained in terms of rational responses to economic conditions.

Research Approach

In the literature on occupational choice, two primary models have been used to predict the probability of an individual entering a certain occupation over another. These are the multinomial and conditional logit models. The primary difference between the two is that the multinomial logit makes the choice probability a function of individual characteristics (such as race, sex, and family background) while in the conditional logit the probability is a function of characteristics of the choice (such as expected income and chances of career advancement if we are considering occupational choice). The nested logit model which is employed here is an extension of the multinomial logit model which allows the choice decision to assume several stages and by taking into account similarities among certain choices. In effect, it is a sequential form of the multinomial logit. A classic example of where the nested logit should be used is in the occupational choice of someone considering a science and engineering career. A model which treats say, mechanical and electrical engineering and economics as having independent stochastic elements can be deceiving. This is a potential problem of using the multinomial logit. One would expect the engineering and social sciences to be more distinct than fields within these sciences. The nested logit model addresses this problem.

The model estimated here is one of choice among the broad occupational categories of professional, managerial, clerk, crafts, operative, laborer, and farmer. A multinomial logit model would treat these seven occupations as independent choices. The nested model of this paper however, groups professional-managerial and operative-laborer into composite occupations because they are related. The decision process is then to form composite occupations and then choose one of the remaining occupations (including the composites).

Estimates of the occupational choice model are obtained using a subset of the Panel Study of Income Dynamics (PSID), which

>>> inbox:804

Date: Fri, 11 Jan 91 10:41:13 EST
From: "F. Karl Willenbrock" <kwillenb@note.nsf.gov>
Subject: Shortfall Issues

------- Blind-Carbon-Copy

To: jhays
Subject: Shortfall Issues
Date: Fri, 11 Jan 91 10:41:13 EST
From: "F. Karl Willenbrock" <kwillenb@note.nsf.gov>

In response to your note message, I should like to suggest:

- invert the order of your proposed action by discussing with Mary Clutter first and then Fred Bernthal,

- you not underplay the urgency of the problem since the January 7, 1991, issue of "The Scientist" also has an article on the "shortage,"

- you not assume that only the engineering community is involved since members of the National Academy's Commission on Physical Sciences, Mathematics and Applications have strongly disagreed with the conclusion,

- the proposal that the research results be controlled in any way by NSF is totally unacceptable,

- that you not assume that criticisms are only on the demand side since at the meeting of STIA's Advisory Committee on Data and Policy Analysis on January 9, several members, particularly Professor Ed Tufte of Yale critized the supply side analysis.

------ End of Blind-Carbon-Copy

MEMORANDUM
February 5, 1991

TO: Walter Massey

FROM: F. Karl Willenbrock

RE: Possible Questions on Supply of Scientists and Engineers

Prior to my appointment as AD, figures predicting an enormous shortfall in future years in the production of scientists and engineers in this country were used by the NSF. Senator Kennedy quoted these numbers when he introduced his "Excellence in Science and Mathematics" bill.

Subsequently, the validity of these shortfall figures has been questioned by numerous parties, including the Commissioner of Labor Statistics Janet Norwood, who recently met with our new Advisory Committee on Data and Analysis. The engineering community in particular (NAE, Engineering Manpower Commission) has objected to these numbers. One critic went so far as to characterize the utility of these figures as "not much better than chicken entrails" (Sharon Begley, Newsweek, January 14, 1991).

In light of the controversy over these shortfall figures, you may be asked your views on this matters at your confirmation hearing. The following are the two questions you might be asked, along with suggested approaches which you may wish to take in responding to them:

(1) "Do you believe that there is a shortage of scientists and engineers in the US?"

Possible Response: "I believe that there is a definite need to increase scientific and technological capability and literacy in the US today. Improving the quality of scientists and engineers produced in the US will help to achieve this objective. Retraining personnel among the various scientific and engineering disciplines to alleviate the spot shortages of professionals in certain fields will also help to advance this goal."

(2) "How could NSF come to have produced a shortfall estimate that appears to be inaccurate?"

Possible Response: "Like many of my colleagues in the scientific and engineering community, I am deeply concerned about the validity of the shortfall figures released under the auspices of NSF. Maintaining the credibility of NSF outputs is critical to preserving its ability to advance the scientific and technological interests of the US. It is my understanding that a very competent external Advisory Committee on Data and Analysis is examining NSF's program and additional external manpower studies are being funded. Any incident, such as the release of unreliable data, cannot be tolerated."

[22] From: "Mary J. Golladay" <mgollada> at NOTE 2/3/91 6:12PM (3720 bytes: 79 l
n)
To: rbye at nsf3
cc: mcehelsk, mgolladay at NOTE
Subject: Comments on draft statement on Future Supply of S/Es
---------- Message Contents ----------
A flu bug downed me before I got my comments to you on the draft discussing NSF and projections/forecasts. I realize that my general notes are hence of limited value, but I'd like to call your attemtion to the historical SRS concern with the PRA documents. I'm sending a memo through the mail, but I'll try to add a copy here as well:

National Science Foundation
Washington, D.C. 20550

MEMORANDUM

DATE: February 3, 1991

TO: Ray Bye
Director, Office of Legislation and Public Affairs

FROM: Program Director
Science and Engineering Education and Human Resources Program, SRS

SUBJECT: Comments on Draft Statement on the Future Supply and Demand for Scientists and Engineers

Thank you for the opportunity to comment on this draft document. It was very interesting, and the ideas are very well expressed. However, the document was disconcerting--perhaps because its title i[redacted]

The draft seems to tie NSF programs in mathematics and science (for which there is a clear need) [redacted]. The NSF programs could suffer from this link.

The section on pages 2-3 titled The Scientific and Engineering Personnel Issues does a good job of showing that NSF concerns and programmatic initiatives do not have to call upon projections, an important point. The last paragraph of this section might cast NSF in a more active role. [My only detailed comment here would be to suggest a softening of the reference to foreign national S/E Ph.D.s--U.S. citizens showed increases in some fields in 1989, so the picture is not unrelieved gloom.]

The following section on the role of Personnel Projections is more disturbing, because it seems to tie projections to a justification of NSF programs. I'd suggest removing it.

In the final section, on Future Initiatives, the first paragraph states the technical problems with forecasts rather clearly. The first sentence pointing out the appeal of forecasts could be moved to the second paragraph suggesting ways NSF might handle projections.

Projections will always draw criticism. The discussion in this draft of the differences in needs and demand is one example. The PR[redacted] for good C[redacted] G[redacted] I[redacted] S[redacted]

At [redacted] single group both [redacted] projections (or forecasts) and [redacted] t[redacted] for f[redacted]

[23] From: cwise 1/30/91 6:50PM (5692 bytes: 2 ln, 1 fl)
To: mgrucza, rbye, cwise
Subject: Shortfall rewrite
---------- Message Contents ----------

Text item 1:

Attached is the shortfall rewrite I discussed with Ray yesterday.
I'll try to have the critical technologies paper done by Friday.

Jan 7 10:42 1991 Page 4

. / inbox:791

Date: Mon, 07 Jan 91 09:22:57 EST
To: Judith Liebman <liebman@ux1.cso.uiuc.edu>
cc: kwillent, ckruytbo
From: Carlos Kruythosch <ckruytbo@note.nsf.gov>
Subject: Re: STIA Advisory Committee activity

Sorry for the delay in answering. I just returned from Spain where I was visiting my father who recently suffered a stroke.

Re your question about the two reports. All the Committee members were sent a copy of "Surveying the Nation's S/E's". We will have copies of the PRA report, "Future Scarcities of S/E's" available at the meeting.

We have also made some adjustments in the agenda such as, -- shifting Acting [illegible] Bernthal to 3pm -- at his request, and a couple of changes in order of presentation. I'll e-mail you the revised agenda [illegible] today.

MEMORANDUM

DATE: March 11, 1991

TO: Dr. Donna Fossum, Executive Secretary, STIA
Advisory Committee on Data and Policy Analysis

FROM: Director, Division of Policy Research and Analysis

SUBJECT: Transcripts of Committee Meetings

I am requesting a copy of the tapes of the proceedings of the recent meeting of the Advisory Committee for Data and Analysis as soon as possible. Since the meeting on March 7 was public, there should be no restrictions for me to obtain copies of the tapes. If there is a problem having such copies made, I will assist in doing so if you desire. I will, of course, personally reimburse the government for any costs of obtaining these items.

The tapes of the first meeting were used to transcribe the proceedings. Although this was unheard of in STIA before that time, I assume, since the proceedings of the second meeting were as useful as the first, that this practice will be continued. I would also like to be able to read this document when it is available.

To avoid a repetition of the technical errors in the first set of minutes, I would like to receive a copy of the draft minutes before they are circulated to people outside the Committee.

Thank you for your attention.

Peter W. House

2/4/91

Karl's

(1) My draft on NSF-wide [illegible] + data functions — including some detail on SRS. (as requested by Committee)

(2) Additional copy of Committee Minutes of Jan 9 meeting - for Judith's signature

(3) 20 Copies of the OTA study on Statistical Needs for the U.S. [illegible] are on their way

(4) Michael Teitelbaum of the Sloan Foundation — referred to by Jesse Ausubel — has been looking at effectiveness of projections of S/E labor force. He's willing to come + talk on March 7 if we want!
Note also, SRS sponsored a series of projections by 2 economists at U. [illegible] I would like to get a copy of this + will give you my thoughts as to what [illegible] see it.

NOTE: The Data tables need work !!

cek draft 2/4/91

NSF S&T DATA AND ANALYSIS ACTIVITES

I. INTRODUCTION

No country in the world can match the U.S. in the breadth and depth of information about science and technology available to policy and decision makers. This is in major part due to the foresight of the Congress in its legislation requiring the National Science Foundation (NSF), "...to provide a central clearinghouse for the collection, interpretation, and analysis of data on the availability of, and the current and projected need for, scientific and technical resources in the United States, and to provide a source of information for policy formulation by other agencies of the Federal Government". FN

FN The various sections of the NSF Act, and other legislation bearing on data collections are listed here:

-- NSF Act:
   o Sec.3(a)(6) ["Central Clearinghouse of data"] and and (7) [Federal funds data];
   o Sec.4(j)(1) [Science Indicators biennial report];
   o Sec.14(i) [confidentiality of data]
-- Science and Technology Equal Opportunities Act (Public Law 96-516): Sec.37(a) [Minorities and Women biennial report]
-- Public Law 99-159, Sec.108. [Academic Research Facilities survey]

In 1975, even after a 5-year period of slow S&T growth, the U.S. stood as the unquestionable world leader in the support and performance of S&T, and especially in monitoring and tracking S&T developments. A vigorous academic research community of social and economic studies of science and technology received significant Federal support from a variety of sources to provide investigations of emerging trends, theoretical interpretations and an outside critique of Federal data gathering efforts.

Today in 1990, despite nearly 10 years of continuous S&T growth, while remaining by far the largest S&T enterprise in the world, the U.S. finds itself surpassed by several countries on such indicators as, R&D expenditures as a percentage of GNP, and number of engineers per 10,000 labor force. The U.S. has been running fast, but other countries have been running faster.

These patterns of rapid growth have stimulated governments world-wide to generate data about their burgeoning S&T investments to assist them in policy development and evaluation of their efforts. Here too, then, we find that the initiative in S&T data collections, research and analysis, and especially evaluation studies, has passed to other countries. NSF expenditures for these activities declined markedly during the decade of the 1980's.

II. POLICY-RELATED S&T DATA AND ANALYSIS AT NSF

A. Types of Policy-related Study Functions

NSF policy-relevant study functions can be divided into four major types. They are performed in several locations in the organization.

1. The National S&T Data Base

The study function for tracking major national S&T policy-relevant variables requires periodic and routine basic data collection activity -- primarily through national surveys. Effort is also expended to compile comparable data for other advanced industrial countries. The principal locales for these activities are in the Division of Science Resources Studies (SRS) in the Directorate for Scientific, Technological and International Affairs (STIA), and the Office of Studies and Program Assessment in the Directorate for Education and Human Resources (EHR). The latter has been exclusively concerned with data about precollege mathematics and science learning and teaching. The function also requires research studies and experimentation to improve existing data, and to devise new indicators of changing phenomena.

2. Analytical Studies of U.S. S&T

This function consists of longer-term, policy-related studies of emerging trends and changing patterns of S&T support and performance, as well as socio-economic effects of S&T. These studies were traditionally carried out by grantees and contractors supported by a variety of NSF offices. At present, (Jan.1991) some in-house analyses relating to academic research are performed in the Division of Policy Research and Analysis [PRA], STIA, and some extramural studies in pre-college mathematics and science learning are supported by the Office of Studies and Program Assessment [OSPA], EHR. One or two related studies a year are supported by NSF basic social science programs, e.g., sociology, economics, in the Division of Social and Economic Sciences (SES). Other than these, this function has been reduced to a low level of activity over the past decade.

3. NSF Policy-focussed Studies

These are shorter-term studies of specific NSF action issues, often accompanied by options for NSF action. The turn-around time for such studies is generally short -- from a few weeks to a few months. The principal clients are the NSF Director and the National Science Board -- often in response to Congressional or Administration concerns. The primary responsibility for such studies currently lies with the STIA Division of Policy Research

and Analysis (PRA). However, depending upon a variety of circumstances, they may also be conducted in the Director's staff offices -- Office of Budget and Control (OBAC), and Office of Legislative and Public Affairs (OLPA) -- in STIA/SRS, or in other Directorates.

4. NSF Evaluation Studies

An ongoing program of evaluative studies of NSF programs and processes is conducted by the Evaluation Staff (ES) in OBAC. The results frequently have important implications for NSF as well as national science policy. Their studies often link the data bases about NSF's own activities with national S&T data bases.

B. NSF Organizational Arrangements for S&T Studies

1. The national S&T data base

For about three decades the "tracking" function referred to above has had a more or less stable organizational existence at NSF, although it has undergone name changes and shifts on organizational locale. The principal activities of the current SRS Division are described in Appendix B. By 1959 there was a NSF Director's staff office -- initially named Office of Program Analysis, later Office of Special Studies --- with 33 personnel working in six programs covering more or less the same topics as today. In 1964 it was renamed the Office of Economic and Manpower Studies, within the Director's Division of Planning. By 1966 the staff complement had grown to 67 persons.
In 1971 the group became the Division of Science Resources Studies and moved out of the Director's staff into the Directorate for Science Education. In 1975 the SRS was made an element of the new (catchall!) Directorate for Scientific, Technological and International Affairs (STIA). It is worth noting that from 1971 to the present the Division has been physically separated from the main NSF building.

While the budgets for these activities have grown over the years, they have increased at significantly below the overall NSF growth rate. See Table A.

TABLE A
Rates of Change in Budgetary Obligations
for Total NSF and for SRS

Change period:	1970-1980	1980-1990
Total NSF budget	108%	114%
SRS budget	59%	54%

These slower growth rates have not matched the significant expansion of the Division's responsibilities during the 1980's, including:

-- major new surveys on:
public attitudes toward science and technology,
academic research instrumentation, (Congressionally mandated)
academic research facilities, (Congressionally mandated)
State R&D expenditures

-- special analyses and data compilations on such topics as:
foreign students,
statistical profiles of eight major disciplines
minorities and women in science (Congressionally mandated)

The accretion of these tasks without corresponding additional resources, resulted in both postponement of needed studies to improve and update survey instruments and categories in rapidly changing circumstances, as well as curtailment of SRS's analytical studies functions. (more on this below)

2. Policy Studies focussed on NSF Policy Options

Organization for shorter-term, NSF policy-specific studies has undergone several sharp discontinuities over the past decade.

a. The History to 1984

For the first 30 years of NSF these activities took place in the Director's staff offices under various names. From 1975 to 1983 a small staff of 4 to 8 people operated in the Office of Planning & Policy Analysis (PPAO), which in turn was part of the Director's central budget and program analysis staff, the Office of Program and Resources Management (PPAO/OPRM). The PPAO performed both shorter-term NSF policy specific studies for the Director and the National Science Board, as well as longer-term NSF policy related studies of developments in the science and technology communities that were seen as relevant to NSF/NSB policies. Juxtaposed under the same OPRM Director with the NSF budget staff, and providing the principal staffing (executive secretaries) for NSB committees and task forces, the staff was in close contact with current and emerging issues. The PPAO also provided the staff for coordinating NSF's annual long-range planning exercise, thus putting them in close touch with the Divisions and Directorates. During this period the staff also possessed the strong analytical and methodological skills necessary to design and implement sound studies, as well as knowledge of and access to NSF's own budget and proposal data-bases.

During their terms of office Directors Richard Atkinson (77-80) and John Slaughter (80-82) made full use of their policy analysis capability. But, in contrast to his predecessors, NSF Director

Knapp (82-84) requested virtually no policy studies from PPAO/OPRM for the Director's office. PPAO activities were thus reduced to providing staff support for NSB Committees and performing some NSF long range planning functions such as preparation of the Status of Science Reviews document. In 1983, toward the end of Knapp's term, OPRM/PPAO was disestablished -- the budget portion becoming the present Office of Budget and Control (OBAC), and responsibility for the NSF policy studies function being transferred to the Division of Policy Research and Analysis in STIA. Some residual NSF Planning and Special Reports functions were transferred to a small new group "Planning and Special Projects" (PSP) reporting directly to A/D STIA. This group was dissolved within two years.

Since its establishment in 1975 with the creation of STIA, the PRA program had consisted of three major thrusts: a grant program for long-term studies of the economics of research (more on this below), and two programs concerned with developing methodologies for and conducting certain kinds of science and technology policy analysis such as risk assessment (not directly related to NSF policy issues), and for performing studies of certain national S&T policy issues for OMB and OSTP.

b. Developments under Director Erich Bloch

The policy studies stage was thus set for the advent of Director Bloch in 1984. PRA/STIA had been given the NSF policy studies function by a Director who had made no use of it. Further, the excellent PRA staff had virtually no experience with NSF-focussed policy issues and the peculiarities of the NSF data bases. Nor had they the knowledge of and connections with the NSF research programs necessary for effective policy studies of NSF concerns. They required time to acquire these skills and relationships.

The new Director Bloch thus found he had a seriously flawed capability for analysis of NSF policy issues. This was directly reflected in drastic budget cuts for PRA from over $4 million in 1983 to $850,000 in 1988. The staff was also cut proportionately. The first activities to go were the non-NSF policy analysis functions. However, the pressure for short-term NSF policy studies on the remainder of the staff and resources resulted in eliminating the longer-term R&D policy research program, especially the important studies on the relationships between science and engineering research and the economy.

3. Policy-related Studies of Changes in the Structure of R&D, and Socio-economic Effects of R&D

NSF's arrangements for longer-term, policy-related studies of developments and changes in the support and performance of science and engineering research have tended to be ad hoc in nature, in part because the policy urgency for studies on particular topics is

difficult to predict. With the exception of the now-defunct STIA/PRA program of studies on economic effects of R&D (see below) has never had a regular program of research on research. It is often argued that such a special program is not necessary because research proposals in this area can be made through NSF's basic research programs in social sciences -- Sociology, Economics and Political Science. Whatever the reason, very few important studies have been generated in this manner.

Despite its ambivalence about programmatic policy-related studies, NSF has produced a surprising number of excellent longer-range studies over the years. Credible descriptive and analytical studies of key aspects of the research system have provided a sound basis for policy formulation, program planning, and the creation of periodic tracking surveys. A selection of such studies is listed below, with the diversity of sources reflecting the diversity of policy needs:

o NSB Annual Reports between 1969 and 1982 included in-depth longer-term studies of graduate education in science and engineering, basic research in the federal mission agencies, and industry-university research relationships. Nine editions of the NSB's Science Indicators between 1972 and 1989 summarized available quantitative information about developments in the science and technology system from NSF and other sources in a convenient format for policy makers. Many new "indicators" of emerging S&T phenomena resulted from the small SRS/Science Indicators extramural awards program for this purpose.

o The NSB Special Commission on Precollege Education in Mathematics and Science generated much important information on this critical area of the S&T system. A special two-year staff was created to carry out this mission. Currently, an active and well-funded grants program in the EHR Directorate (Office of Studies and Program Assessment) is developing long-term studies of the functioning of science and mathematics learning at the precollege level which are essential to sound NSF policy development in this area.

o Fundamental investigations of the role of R&D in the economy were funded with grants from the R&D Assessment Program (72-75) and the STIA/PRA subprogram (75-85). They supported such leading scholars as Mansfield, Denison, Griliches, and others, and provided much of the data and understanding that lie at the core of the justification for support of basic research today. While current policy emphasizes the role of S&E research and training in economic competitiveness, NSF supported research in this area has been virtually at a standstill for half a decade.

o Important policy information about the operations of research was generated in the 1970's by a series of studies of major NSF programs by the Evaluation Staff (OPRM) such as, the

IDOE (International Decade of Ocean Exploration), the BIOMES, the MRL's (Materials Research Laboratories). In addition, this group provided creative analyses of NSF grant support data on policy questions such as, shifts of grant moneys from equipment to support staff during the early 1970's, and outputs from NSF grant programs in several disciplinary areas. In recent years, OBAC's Program Evaluation Staff (PES) has conducted major surveys of NSF proposers and reviewers concerning their participation in, and perceptions of, NSF's peer review process. The PES has completed evaluation studies of a variety of NSF programs, and, until recently, it also oversaw NSF's relationship with the National Academy of Sciences, Committee on Science, Engineering and Public Policy (COSEPUP), which at times performs policy studies for NSF.

o Major long-term studies by the PPAO/OPRM during the 1970's included several on various aspects of the peer review process, a national assessment of the state of academic research, studies on women and minorities in scientific research, studies of the age structure of academic researchers as related to retirement policies and practises and opportunities for young investigators, studies of the need for, and role of, scientific instrumentation in academic research, studies of the role of organized research units in academic science, studies of the role of basic research in newly patented technologies, etc.

o Several useful studies on the functioning of industry-university research relationships were conducted for a few years in the late 1970's and early 1980's by the Productivity Improvement Research Section (PIR) of STIA/ISTI. The program was abolished in the early 80's.

o While the bulk of the activity of SRS/STIA is devoted to a dozen major recurrent surveys tracking S&T resources, since the mid-1970's it has conducted a small analytical studies activity (both in-house and through grants) which has produced significant work in the areas of technological innovation, and S&E manpower modeling. The Science Indicators awards program has also produced useful new S&T indicators for the NSB publication.

4. The current situation regarding longer-term studies

As shown in Table 1, while NSF resources for policy studies have declined by over 60% since 1980, the portion of study resources available for longer-term studies has shrunk more dramatically by about four-fifths.

Some degree of pruning of NSF resources for S&E studies over the past decade was justified because some studies units were clearly not producing NSF related work. But, the excessive vigor with which the pruning was conducted disproportionately cut the longer-term studies efforts. After all, when under pressure, shorter-term results are critical to survival of small units. However, the

result has been that NSF as a whole has lost an important capability for developing credible "early warning" information on new developments in the S&T system.

It is clear that major NSF policy thrusts in such areas as science and engineering research centers, and building a national research and education infrastructure to enhance economic competitiveness, are not being tracked and placed in context by serious NSF funded research into the conditions and consequences of such policies. NSF should have significant studies under way on, e.g., the role of different kinds of research and both graduate and undergraduate science, mathematics and engineering education in economic growth and competitiveness, and on changing organizational arrangements for the conduct of research (e.g., academic research centers) and their implications for innovation and creativity.

V. CONCLUSION

NSF policy studies have been in some disarray over the past decade. Basic tracking functions have been supported at bare-bones levels, with little opportunity for needed maintenance and improvement work. Shorter-term policy studies have been organizationally wrenched back and forth, making productive work difficult. And longer-term studies of the structure and function of the U.S. research and training effort are virtually at a standstill.

APPENDIX A

NSF resources for longer-term studies of science and engineering research performance and organization.

During the 1980's NSF's capability to support policy-related studies of S&E research infrastructure (excluding precollege science and mathemtics education studies) has decreased by about

70% -- from over $6 million in 1980 to less than __ million in 1989. (See Table 1). Most of the reduction has been in the support for longer-term studies of changes and developments in the organization and performance of research. In 1980 about half of the available funds were for longer term studies ($3.1 million), and currently only _$_____ of the much smaller total is for longer term studies.

Table 1

NSF Resources for Policy-Related Research
1980 and 1986 ($millions)

Program		1980	(LT)	1986	(LT)	1989	LT
PPAO	Director's policy	0.8	0.4	-	-	-	-
PRA -	Technology Assessment	1.0	-	-	-	-	-
PRA -	Longer-term studies	1.0	1.0	-	-	-	-
PRA -	Short-term policy work	1.0	-	1.0	-	0.8	-
ISTI	Productivity improvement	1.0	1.0	-	-	-	-
SRS	Science Indicators	0.6	0.3	0.4	0.2	0.2	-
SRS	International	0.4	0.2	0.2	0.1	0.1	0.1
OBAC	Director's Evaluation	0.4	0.2	0.2	0.1	( )	( )
TOTAL		6.2	3.1	1.8	0.4		

Note: LT= longer term studies. All the numbers are approximate. Occasional relevant S&E infrastructure studies have been supported out of research programs.

A new actor on NSF's policy-relevant studies stage emerged with the 1984 launch of a $1.8 million program of studies in the Office of Studies and Program Assessment of the Directorate for Science & Engineering Education. By 1989 expenditures had risen to $4.5 M. Senate legislation for FY1991 requires NSF to deliver a variety of studies and analyses of the Federal role in science and mathematics education, thus assuring further growth of this function.

APPENDIX B

Program of Activities of the Division of Science Resources Studies

SRS activities can be described under four major categories:

1. Data collections -- the surveys and other compilations
2. Periodically required reports and analyses
3. Special reports and analyses
4. Public dissemination of data

1. Data Collection

Table 1 lists 15 major surveys and several other data compilations conducted by SRS in a variety of cycles. Most of the actual data collection activities are performed by contractors selected under periodic "Requests for Proposals". However, the survey designs as well as the analyses and reports are closely monitored and often completely written by the SRS staff.
This category of activities consumes the bulk of SRS' program budget, as well as the majority of staff time.

2. Periodic reports and analyses

The data from all of the surveys mentioned above are published by SRS as compilations of tables together with technical notes on definitions and methodological procedures. For many of the surveys, an early release, one-to-four page, flyer is published containing a few charts and tables with narrative describing the major findings of the survey. In cases where reports derived from a survey are Congressionally mandated, more extensive analyses of the data are performed and a descriptive narrative is produced with appropriate selected data displays -- e.g., the reports on the surveys of Academic Research Instrumentation and Academic Research Facilities.

More synoptic reports such as the Congressionally mandated such as the biennial Science & Engineering Indicators reports and the annual Women and Minorities in Science and Engineering are written in-house by one or more staff with expertise in the topical areas. These reports draw primarily upon the store of SRS survey data, but also include data from other sources. For example, approximately half of the data displays in the Science & Engineering Indicators volumes are derived from non-SRS sources.
The annual report National Patterns of R&D Resources summarizes the newly available SRS data with narrative and summary displays, as well as appendix tables with more extensive data tabulations.
The annual Federal R&D Funding by Budget Function essentially analyzes the currently proposed presidential budget for over 500 Federal R&D programs. Its production cycle is timed to coincide with Congressional debates about the budget. This is also the case with the more extensive biennial Science & Engineering Indicators

report. In recent years it has been extensively utilized by the President's Science Advisor in his posture statements on the science budgets before Congressional Committees.

The International S&T Data Update volumes provide a comprehensive compilation of all the available international comparative data on Science and Technology. Some of these data are compiled by SRS staff in collaboration with extensive international contacts, and some are the results of special contractor or grantee studies. Similarly, the bibliometric data extensively used in the Indicators volumes are compiled and analyzed by a contractor in close consultation with SRS staff. The data on U.S. patents used in the same volumes are purchased from and run by the U.S.P.T.O. in accordance with the analytical specifications set by SRS staff.

3. Special reports and analyses

Almost every year the SRS performs special data compilation and analysis projects, primarily for the NSF Director's office. Many of these are minor, relatively short-term but nevertheless staff time consuming, jobs. But sometimes, the projects are quite extensive, and result in major publications -- e.g., the 1986 Foreign Citizens in U.S. Science and Engineering: History, Status and Outlook. For a number of years SRS undertook to track the advent of emerging areas of science and technology. Two staff directed surveys were conducted on national resources for biotechnology R&D and an in-house analytical compilation of data on superconductivity R&D was published. Also, in an attempt to make SRS data more available to NSF programs, a series of eight "Discipline Statistical Profiles" were published.

Management of SRS' former program of extramural research studies, is also an important activity in this category, requiring careful staff attention to the design and reporting of the studies. Current policy is to reestablish research connections with the scholarly communities interested in S&T policy related studies. A key area of current activity is in modeling S&E labor markets.

4. Public Dissemination of Data

All SRS staff, from support staff to senior analysts, spend hours on the phone each week answering questions about S&T data. One year it was estimated that the Science Indicators staff answered 900 calls about the data. Many times they are simple requests for particular publications. More often, the customer does not know exactly what he or she wants, but needs to be walked through what is available relating to their need. Other times they want to know how technical details about the data. Authors of the surveys and reports are also frequently in demand to provide briefings on their data, especially when it is brand new.

In recent years, SRS has initiated a remote dial-in data retrieval

capability. Certain survey data can be retrieved from SRS's automated computer facility and dumped directly into the customer's computer. Customers can also send in blank diskettes and have them filled to order with available data.

APPENDIX IS TABLE I

NSF Science/Engineering (S/E) Resources Data

Survey name	Frequency	First year of data availability	Most recent data (as of ~~[illegible]~~ Jan. 1991)	APPROXIMATE ANNUAL Man Years ↓	Program Budget ↓
Scientific and technical human resources:					
National Survey of Natural and Social Scientists and Engineers	Biennial	1972	'84 ~~1984~~		
Earned Doctorates Awarded in the United States	Annual	1957	'89 ~~1985~~		
Characteristics of Doctoral Scientists and Engineers	Biennial	1973	'89 ~~1985~~		
Recent Science and Engineering Graduates (New Entrants)	Biennial	1976	1984		
Graduate Science and Engineering Students and Postdoctorates	Annual	1972	'89 ~~1985~~		
Scientific and Engineering Personnel Employed at Universities and Colleges	Annual since 1973	1954	1985 DISCONTINUED		
Research Participation and Characteristics of Science and Engineering Faculty	Periodic	1968	1986		
Scientific and Technical Personnel in Private Industry	Annual, 3-year cycle	1977	1986		
Federally Employed Scientists and Engineers	Annual[1]	1954	1986		
Foreign Scientists and Engineers	Annual	1966	1986		
Science and technology funding resources: State R+D Exp.	Periodic	1977	'89		
Federal Funds for Research and Development	Annual	FY 1967	'91 FY ~~1986~~		
Federal Support to Universities, Colleges, and Nonprofit Institutions	Annual since 1968	FY 1963	'89 FY ~~1985~~		
Scientific and Engineering Expenditures at Universities and Colleges	Annual since FY 1972	FY 1963	'89 FY ~~1985~~		
Industrial Research and Development	Annual	1953	'89 ~~1985~~		
Science and technology inputs and outputs:					
Academic Research Instrumentation Needs	Biennial	1983	1985/86		
Academic Research Science Indicators Literature Data Base FACILITIES	Biennial	1986	1990		
Public Attitudes Toward S+T	Annual[1]	1973	'86 ~~1985~~		
Counts of Patents Applied for and Granted in the U.S.	Biennial	1979	'88		
International S+T Data	Biennial Annual	1963 1984	'88 ~~1988~~ 1988		

[1] Earlier data from these surveys were used by NSF in analytic reports; complete time-series data are not available from NSF

Table 1
Estimated NSF Support for Policy Studies, 1980 and 1986
($Millions) *

	1980	1986
National Data Base	3.0	3.5
NSF Policy Studies (shorter-term)	4.4	2.4
R&D Studies (longer term)	2.5	0.4
Total NSF Policy Research	9.9	6.3

* See Appendix Table 1 for details

DRAFT DRAFT - March 1, 1991 - DRAFT DRAFT

PROPOSED OPERATING PROCEDURES AND PRINCIPLES FOR STIA DATA AND POLICY ANALYSIS ACTIVITIES*

1. STIA should perform the following data collection and policy analysis activities:

   (a) Collect appropriate data to support the Foundation's activities, as well as to provide Federal agencies, the Congress, and the public with data about the status of science and technology and about science and engineering personnel.

   (b) Consolidate existing data on science and technology, whether or not collected by STIA, into a publicly accessible electronic database. This facility should feature a common data dictionary and at least two levels of access, one for NSF and another for external users.

   (c) Provide for analyses and research utilizing the database. These activities should take place both inside NSF and in the external community. STIA should facilitate access to these data and fund analytical and research efforts in cooperation with other Directorates.

   (d) Establish and maintain staff capability to transform the results of this research into information relevant to decision-making and policy formation by NSF, the National Science Board, Executive Branch agencies, and the Congress.

   (e) Provide for professional review of all STIA reports, and thoroughly validate all findings.

   (f) Sponsor targeted research and, in cooperation with other Directorates, untargeted research in the methods and procedures for collecting, analyzing and disseminating statistical information.

   (g) Disseminate reports to the public in appropriate formats.

* Prepared by the staff at the request of the chair on basis of the discussions at the last meeting.

2. STIA should adopt the following guidelines:

(a) All research supported or conducted by STIA should be fully documented so that users can fully understand the procedures employed.

(b) Reports should contain appropriate information about the sources and likely magnitude of uncertainty in the results. In the case of future projections, reports should present scenarios clearly indicating the effects of assumptions on the possible outcomes.

(c) When graphical presentations are used, they should clearly and objectively display [redacted] and results of analyses.

(d) Data users inside and outside the Foundation should play a role in establishing priorities.

(e) STIA should establish a publications review system including peers as well as review by STIA management. Reviewers should consider the quality of data and the validity of the analyses.

(f) STIA should strengthen ties to the Federal statistical community and maintain state-of-the-art professional standards.

MEMORANDUM

TO: SRS Staff

FROM: William W. Ellis
Acting Division Director

DATE: February 28, 1991

SUBJECT: SRS Publications Management and Review Procedures
(As revised)

CONTENTS

* * * * * * * *

MANAGEMENT CHANGES

I have determined that the publications process will be greatly enhanced by the centralization of certain editorial and publications management functions. To that end, I am creating the position of Publications Manager in the Office of the Director, SRS. For the time being, I am assigning Richard E. Morrison to my Office for the purpose of organizing and executing these functions until such time as that position can be officially created. He will be making proposals to me on the detailed organization of this work. Millicent Gough and Elizabeth Michael will be assigned to assist him in discharging these responsibilities, and contracted editorial and publications support services will be coordinated through this office. Morrison will participate in the activities of my Office as a member of the senior staff and will have my full backing in discharging his responsibilities.

PROVISIONAL REVIEW PROCEDURES

The following review procedures are in effect until further notice. They are designed to make it possible for us to get our work adequately reviewed to assure that it is of the highest possible quality, without imposing an unreasonable burden on authors or reviewers. They build on earlier efforts to improve the SRS review process. Standards pertain to (1) review and (2) physical production.

(1) Review Procedures

Authors have primary responsibility for producing manuscripts that present information clearly, accurately, and at the appropriate level of detail.

- It will greatly ease our work and diminish misunderstanding if an outline or plan is approved in advance by the Program Director and, when the report is long or highly sensitive, by the Office of the Division Director.

- A review procedure and production schedule for each report should be agreed upon at this stage. Specific external review procedures should be indicated, if they are to be included.

- When the draft manuscript is produced, authors are responsible for certifying the accuracy of all data and charts.

- All review copies should be provided in electronic media, either on diskettes or on appropriate network files when we have determined how to use this capability of the network to best advantage. Conversion of hard copy text and graphics to electronic format is the responsibility of the originating Program.

Program Directors are responsible for the first level intensive review of each draft manuscript developed by members of their Program Groups.

- The Program Director should determine that each manuscript is what was expected in scope and treatment of the data, as anticipated by the outline or plan and previously approved by the Program Director (and Division Director, if applicable).

- Before a manuscript leaves a Program Group, it should be edited and revised to meet the standards of lucid and concise English, and should be free of typographical errors.

- In addition, the Program Director should arrange a documented, independent check of all data, whether in tables or charts.

- The Program Director should pay special attention to the relationship of a particular manuscript to other documents produced by the Program and Division.

Division responsibility. The Publications Manager, Office of the Division Director, will review each manuscript for conformity to NSF policies and for consistent relationship to other SRS publications. This Office will also conduct both substantive and technical editing, as appropriate and as personnel resources permit.

- The substantive review will be conducted by the Division Director or Deputy Director, or, at their option, they will identify professionals from other programs in the Division to conduct substantive reviews.

- Technical editing and proofreading will be conducted by staff in the Director's Office.

- Every effort will be made to adhere to the agreed upon production schedule specified earlier in the process.

External review. External review is a vital part of the production of any body of professional literature, and SRS reports are not only professional in their importance and content, but of vital interest to our attendant publics in the Executive Branch, the Congress, professional associations, the higher education community, nonprofit organizations, and industry. External review will assure that our reports are standard authorities in these circles.

- The extent of external review will be specified in the review procedure and production schedule, and will vary from document to document, with the same or very similar procedures and schedule pertaining to similar reports. Some documents may not be subjected to external review at all; examples might include early release tables and similar noninterpretive documents.

- In consultation with the Assistant Director/STIA, the STIA Advisory Committees, and outside organizations, an Editorial Board for our publications will be established, representing the broad array of skills and expertise in our work.

- Under most circumstances, two persons will be selected from this Board by the Office of the Division Director to review a document that is submitted to external review, and the external review plan will be included as part of the review procedure and production schedule.

- External reviewers will be asked to focus their attention on substantive concerns, with technical editing to remain the province of our own editorial capabilities. External reviewers will be asked to provide comments in writing, and will be given clear deadlines.

- External reviewers' comments will normally be considered in a conference including the Office of the Division Director, Program Director, Publications Manager, and author(s). On some occasions, however, the comments may be so limited that a meeting may not be necessary.

- Documents such as Detailed Statistical Tables may be handled differently. For example, the Office of the Division Director may elect to have them reviewed in groups periodically with the goal of improving the general approach of the presentation, as opposed to addressing the particularities of a specific report.

- Publications prepared or edited under the guidance of outside contractors are subject to the same review procedures as those prepared or edited internally.

STIA role. The Assistant Director/STIA is responsible for all of our publications, and hence, has an important and legitimate role in our review process. However, the institution of a systematic external review procedure, supported by a functional SRS Editorial Board, will vitiate the need for detailed and time-consuming STIA reviews. It is anticipated that such reviews will become *pro forma*.

The Division Director will bring to the notice of the Assistant Director/STIA any aspect of a publication that merits special attention. In particular, reports that have substantial public policy content and include include controversial information will be highlighted.

(2) Physical production

General. SRS should make every effort to streamline the production of manuscripts.

- Text, graphics, and tables prepared by authors or other staff may be initially generated either by hand or by computer, depending on the skill level and preference of the author. But before they are passed on for editing, they must be in machine readable format on diskettes or, when we have determined how to do this, on the network.

- Survey contractors or SRS staff will be expected to produce camera ready tables for Detailed Statistical Tables and appendices for reports.

Release of data. We will be generating a clear policy on the release of data that will be fully cognizant of relevant law, regulations, and practices. Until we have that in place, we will continue to do all data releases on an ***ad hoc*** basis, with guidance from Donna Fossum, the Acting Deputy Division Director.

[end]

January 1991 1200

Directorate for Scientific, Technological, and International Affairs

INTERNAL ROUTING SLIP

To	Name	Action	Initial	Date	To	Name	Action	Initial	Date
	Willenbrock				[redacted]				
	Szwest				X	DD (SRS)			
					X	DD (INT)			
					X	DD (ISTI)			
					X	OH (EPSCoR)			
					X	Marta Cehelsky			
X	Glaser								
	Richardson					AO (PRA)			
	Lederman					AO (SRS)			
	Dickens					AO (INT)			
	Arnold					AO (ISTI)			
	McKay								

Attached for your information are the agenda and membership list for the March 7 meeting of the Advisory Committee on Data and Policy Analysis. Also attached are the summary and detailed minutes for the January 9, 1991, meeting of this committee.

1. Note and forward	6. Concurrence	11. Recommendation
2. Note and return	7. Draft Reply	12. Please see me
3. Note and file	8. For signature	13. Investigate and report
4. Per your request	9. For comment	14. Keep me advised
5. For information	10. For correction	15. Necessary action

From: F. Karl Willenbrock | Date: 3/5/91

NSF Form 8 — January 1991

FINAL AGENDA

STIA ADVISORY COMMITTEE ON DATA AND POLICY ANALYSIS
NATIONAL SCIENCE FOUNDATION
1800 G STREET, N.W.
WASHINGTON, D.C. 20550
Room 540

8:30 a.m. - 4:30 p.m.

8:30 a.m.	Opening Remarks Approval of Agenda Approval of Minutes Dr. Judith Liebman, Chairperson
8:45 a.m.	NSF Update Dr. F. Karl Willenbrock Assistant Director, STIA
9:00 a.m.	Inter-Directorate Activities and Opportunities Dr. Mary Clutter, Assistant Director, Biological, Behavioral, and Social Sciences (BBS) Dr. Roberta Miller, Director, Division of Social and Economic Science, BBS
9:30 a.m.	Discussion of Current and Past Publications of SRS Dr. William W. Ellis, Acting Director, Division of Science Resources Studies, SRS
10:00 a.m.	Presentation of Proposed Operating Procedures and Principles
10:30 a.m.	Break
10:45 a.m.	Discussion of Proposed Operating Procedures and Principles
Noon	Lunch
1:00 p.m.	Presentation of Proposed Guidelines for the Technical and Policy Review of STIA Data and Policy Analysis Publications
1:30 p.m.	Discussion of Proposed Guidelines for the Technical and Policy Review of STIA Data and Policy Analysis Publications
2:30 p.m.	Break
2:45 p.m.	Outline of Report to STIA Advisory Committee
4:00 p.m.	Schedule and Agenda for Next Meeting
4:30 p.m.	Adjourn

REVISED AGENDA

STIA ADVISORY COMMITTEE ON DATA AND POLICY ANALYSIS
NATIONAL SCIENCE FOUNDATION
1800 G STREET, N.W.
WASHINGTON, D.C. 20550
Room 540

8:30 a.m. - 4:30 p.m.

8:30 a.m.	Opening Remarks Approval of Agenda Approval of Minutes Dr. Judith Liebman, Chairperson
8:45 a.m.	NSF Update Dr. F. Karl Willenbrock Assistant Director, STIA
9:00 a.m.	Inter-Directorate Activities and Opportunities Dr. Mary Clutter,* Assistant Director, Biological, Behavioral, and Social Sciences (BBS) Dr. Roberta Miller, Director, Division of Social and Economic Science, BBS
9:30 a.m.	Discussion of Current and Past Publications of SRS Dr. William W. Ellis, Acting Director, Division of Science Resources Studies, SRS
10:00 a.m.	Presentation of Proposed Operating Procedures and Principle
10:30 a.m.	Break
10:45 a.m.	Discussion of Proposed Operating Procedures and Principles
Noon	Lunch
1:00 p.m.	Presentation of Proposed Guidelines for the Technical and Policy Review of STIA Data and Policy Analysis Publications
1:30 p.m.	Discussion of Proposed Guidelines for the Technical and Policy Review of STIA Data and Policy Analysis Publications
2:30 p.m.	Break
2:45 p.m.	Outline of Report to STIA Advisory Committee
4:00 p.m.	Schedule and Agenda for Next Meeting
4:30 p.m.	Adjourn

*Invited

STIA ADVISORY COMMITTEE ON DATA & POLICY ANALYSIS

Membership list (1/9/91)

1.	Beyer, Janice	Rebecca L. Gale Regents Professor, College of Business Administration University of Texas at Austin
2.	Flamm, Kenneth	Senior Fellow, Brookings Institution
3.	Goldman, Alan	Professor of Mathematical Sciences, Johns Hopkins University
4.	Howard, William	Senior Fellow, National Academy of Engineering.
5.	Liebman, Judith (Chairman)	Vice Chancellor for Research, University of Illinois at Urbana
6.	Link, Albert	Professor of Economics, University of North Carolina at Greensboro
7.	Loweth, Hugh	former Deputy Director for Energy & Science, Office of Management and Budget
8.	Lukasik, Stephen	Vice President and Chief Scientist TRW, Space and Defense
9.	Robert Morgan	Professor of Technology and Human Affairs, Department of Engineering and Policy, Washington University
10.	Mowery, David	Associate Professor, Walter A. Haas School of Business, University of California at Berkeley
11.	Nicholson, Richard	Executive Officer, American Association for the Advancement of Science
12.	Shanks, Merrill	Professor of Political Science, University of California at Berkeley
13.	Tufte, Edward	Professor of Political Science & Statistics, Yale University
14.	Wallman, Katherine	Executive Director, Council of Professional Associations on Federal Statistics

Summary

Advisory Committee on Data and Policy Analysis
Directorate for Scientific, Technological, and
International Affairs (STIA)
National Science Foundation

Meeting of January 9, 1991

The newly created STIA Advisory Committee for Data and Policy Analysis, chaired by Dr. Judith Liebman, held its first meeting on January 9, 1991 at the National Science Foundation. STIA Assistant Director, Dr. F. Karl Willenbrock, gave a charge to the Committee of helping the STIA Directorate in its efforts to increase the quality and credibility of its data and policy analysis activities. He then introduced Dr. William Ellis, the new Acting Director of the Division of Science Resources Studies (SRS).

The Committee heard presentations from three speakers from outside the STIA Directorate: Dr. Luther Williams, Assistant Director of the Directorate of Education and Human Resources (EHR) at NSF, Dr. Janet Norwood, U.S. Commissioner of Labor Statistics, and Dr. Herman Haberman, Chief Statistician at the Office of Management and Budget.

Dr. Luther Williams

Dr. Williams described the rapid growth of activities in the EHR Directorate and noted the heavy reporting requirements established by Congress. These requirements, which include preparation of numerous reports, including a biennial report on science and mathematics education indicators, will require substantial data and policy analysis and considerable cooperation between EHR and STIA.

Dr. Herman Haberman

Dr. Haberman described the responsibilities of the Office of Chief Statistician at OMB, which is concerned principally with the credibility and integrity of federal statistical systems. The office works with other Federal agencies in the agency budget preparation process and participates in the paperwork clearance process. He indicated that in recent years, the Administration has requested substantial increases for federal statistical programs.

Dr. Janet Norwood

Dr. Norwood discussed organizational requirements and professional responsibilities of a federal statistical agency. The reproducibility of analysis is central to the preservation of credibility. It requires full disclosure of methodologies and procedures and carefully observing the distinction between analysis and advocacy. She noted that while projections tend to be very popular among users, they do not foretell the future and must be prepared and released so as to

preclude suspicion of political influence. Dr. Norwood discussed Bureau of Labor Statistics (BLS) data collection activities concerning scientists and engineers and ongoing work aimed at improving common definitions and coding procedures. She suggested that an increasing demand for detailed data would make confidentiality the primary issue of the next decade.

Future Supply of Scientists and Engineers

Dr. Peter House gave an illustrated presentation on the future supply of scientists and engineers. He noted that combining demographic factors and degree data provides a means of forecasting the supply of science and engineering personnel. Dr. House also presented an analysis of science and engineering personnel in other countries and discussed the expected impact of a wave of faculty retirements in the late 1990's on demand for science and engineering personnel. Committee members discussed the sources of data underlying these analyses and expressed reservations about the conclusions derived from them. The Committee emphasized the need for utmost care in selecting underlying data and assuring its credibility.

Science and Technology Personnel Data System

Presentations by Ms. Katherine Wallman, from the Council of Professional Associations on Federal Statistics, and Dr. Daniel Melnick, Senior Adviser to the EHR Directorate, covered the status and future directions of STPDS, and reviewed the history of the system. Ms. Wallman was a member of a 1989 study group in the National Academy of Sciences, which identified problems with the design, execution and analysis of NSF's surveys. Dr. Melnick reported that SRS has made progress in implementing many of the Panel's recommendations. Important issues remain, however, including the integration of data from various SRS science and technology personnel surveys to produce national estimates.

Dr. Frederick Bernthal

The Acting Director joined the Committee at the conclusion of the day, welcoming it to the Foundation, and expressing appreciation for its time and effort. Following a summary by Dr. Liebman of the issues discussed in the course of the day, Dr. Bernthal noted

the importance to NSF of having its statistical activities integrated into the professional community of data collectors and analysts in dealing with well-established responsibilities, as well as the new requirements placed by the Administration and the Congress on the EHR Directorate. Dr. Bernthal noted that he shares the Committee's view on the importance of maintaining the fine distinction between data collection and analysis on the one hand and advocacy on the other.

FEB 4 1991

NSF ADVISORY COMMITTEE ON DATA AND POLICY ANALYSIS

Meeting of January 9, 1991, in Rm 543, 1800 G Street, N.W., Washington D.C., 20550, from 8:30am to 4pm

Minutes

Committee Members Present

Dr. Judith Liebman, University of Illinois at Urbana, Chairman
Dr. Janice Beyer, University of Texas at Austin
Dr. Alan Goldman, Johns Hopkins University
Mr. William Howard, National Academy of Engineering
Dr. Albert Link, University of North Carolina at Greensboro
Mr. Hugh Loweth, Consultant
Dr. Robert Morgan, Washington University
Dr. David Mowery, University of California at Berkeley
Dr. Richard Nicholson, American Association for the Advancement of Science
Dr. Merrill Shanks, University of California at Berkeley
Dr. Edward Tufte, Yale University
Ms. Katherine Wallman, Council of Professional Associations on Federal Statistics
Mr. Jesse Ausubel, Rockefeller University (attending as representative of the STIA Advisory Committee)

Committee Members Absent

Dr. Kenneth Flamm, Brookings Institution
Dr. Stephen Lukasic, TRW, Space and Defense Sector

Executive Secretary

Dr. Carlos Kruytbosch

Guests

Dr. Janet Norwood, U.S. Commissioner of Labor Statistics
Dr. Herman Habermann, Office of Management and Budget

Participating NSF Staff

Dr. Frederick Bernthal, Acting Director, NSF
Dr. Karl Willenbrock, Assistant Director, STIA
Dr. Luther Williams, Assistant Director, EHR
Dr. William Ellis
Dr. Peter House
Dr. Daniel Melnick

Introductory Remarks. Drs. Liebman, Willenbrock, Williams and Ellis

The chairman, Dr. Liebman, opened the meeting at 8:40am. Dr. Karl Willenbrock, NSF Assistant Director for Scientific, Technological and International Affairs (STIA) stated the charge to the Committee and his hopes for the results. He said that NSF's data and policy analysis activities are critical to the development of U.S. science and technology, and that, "where we are now is not where we want to be in the future". He said the Committee could make a major contribution in assisting NSF to improve its data collection and policy analysis capabilities, especially in light of the rapidly expanding responsibilities for tracking and understanding developments in the area of Education and Human Resources. He said that particularly important requirements of this effort are: that it adhere to high technical standards and produce quality products; that it have high credibility in the community, and that efforts be made to ensure that the information is not misused.

Dr. Luther Williams, NSF Assistant Director for Education and Human Resources (EHR), described the recent rapid growth of activities in his Directorate, and noted the heavy reporting requirements demanded by Congress -- e.g., fourteen separate reports are required within a year. Among these is a new obligation to deliver a "biannual" report on indicators of science and mathematics education, " distinct from the science and engineering indicators report". He said that this will necessitate a substantial data and policy analysis effort. He expected that the EHR Directorate would rely heavily upon STIA capabilities in this area.

Dr. William Ellis, newly appointed Acting Director of the STIA Division of Science Resources Studies (SRS), introduced the work of his Division, and said he hoped the Committee would help to, "hardwire our work into the professional statistical and analytical communities".

Invited Remarks. Dr. Herman Habermann

Dr. Herman Habermann, Chief Statistician of the Office of Management and Budget (OMB) was an invited speaker. He said that he and his small staff of four, are concerned with the credibility and integrity of the Federal statistical system. The group has the general authority of OMB as well as the specific requirements of the Paperwork Reduction Act. It operates with three primary tools: persuasion and facilitation; working with the agencies in the agency budget formulation process ("this has an effect"!); and participating in the paperwork clearance process. In answers to questions, Dr. Habermann said he felt that in recent years Presidential budgets have done well by Federal statistical programs, but that Congress had often pared down or cut out support for proposed activities. He also pointed out that the overwhelming majority of paperwork clearance requests are approved. The criteria used in clearance include: is the statistical design sound? will the findings be generalizable? are the data collections coordinated with other agencies? what is the "utility" of the effort?

Invited Remarks. Dr. Janet Norwood

Dr. Janet Norwood, U.S. Commissioner of Labor Statistics, an invited guest of the Committee, made extensive remarks on the organizational and professional requirements for a Federal statistical agency. [Her observations are being transcribed and will be issued by the Committee as a separate document.]

Dr. Norwood said that in recent years she has observed escalating Congressional interest in the development of statistical information, "or at least numbers". As a result, new requirements are added to budgets, sometimes resulting in conflicts between Congressional, Administration and Agency interests.

Fundamental requirements for a statistical agency are the develoment and maintenance of credibility, together with the support of the professional community. At the Bureau of Labor Statistics (BLS), she said, a key to meeting these requirements is to operate in a completely open environment.

1. Everything is published, especially the detailed methodologies. In her role as Director she finds she must especially resist the "bias against change" which results both from the bureaucracy as well as data users who don't want to see their time series disturbed. Change is indeed difficult, and most often, "we are adopting the least worst option". She pointed out that wide dialogue on any proposed change is very important.

2. She said that everything done at BLS "must be reproducible". This means detailed documentation of procedures, which becomes especially important in very sensitive data areas such as the economy and employment.

3. Dr. Norwood stressed the importance and the difficulty of maintaining a balance on the "thin line between professional analysis and policy espousal or advocacy ... When you become an advocate, you lose credibility".

4. On the question of misuse of data by users, she said that this is unavoidable, but that the best protection an agency has against this is to have fully documented information about data gathering, data reduction and analytical procedures.

Switching to discussion of BLS data collection activities concerning scientists and engineers (S/E's), Dr. Norwood described the two principal data sources: the household surveys of which the Current Population Survey (CPS) is the most important part; and the surveys of business establishments. She gave a number of cogent examples of the problems involved in each approach, especially in terms of varying definitions of occupations. In the case of the business surveys, she discussed the implications of disparate views of occupations held by employers and employees, the former tending

to stress task orientation, the latter a disciplinary identification.

She described the initiation of a new Collection Procedures Laboratory which will do research and experimentation to improve common definitions, coding procedures, etc. This is a multidisciplinary operation including economists, social psychologists, linguists and sociologists.

Dr. Norwood devoted some time to a discussion of the evolution of "projections" since World War II, when President Roosevelt wanted a statistical picture of postwar country. She said, "BLS projections are its most popular product among users, but the least popular at OMB". While the projections are done very carefully, she noted that one cannot foretell the future exactly, but BLS tells exactly how it goes about making the projections. BLS also publishes the exact schedule for issuing the data, so as to preclude suspicions of political influence on the release of often politically volatile information about subjects such as unemployment. She stated that obviously agencies must make estimates for planning purposes, therefore one might as well have these done by professional statisticians. She said their biennial labor force estimates are published in several installments in the Monthly Labor Review, with carefully spelled out assumptions associated with "Low","Medium", and "High" scenarios.

A number of questions were raised and debated in a lively discussion period. Dr. Ron Kutcher from the BLS, who accompanied Dr. Norwood, pointed out that several revisions of the estimates are made within the biennial cycle, e.g., revisions were issued in October 1990 based on new assumptions concerning defense expenditures. Dr. Mowery raised the issue of "access" to the data systems. Dr. Norwood said that "confidentiality" is indeed very important -- and that with an increasing demand for microdata, confidentiality will become THE primary issue of the coming decade. "The future statistical world will be one of longitudinal micro-data".
If the micro-data are confidential, access by analysts can be difficult. She said that scholars desiring access could be sworn in as BLS agents, but that this was cumbersome, and would require their coming to Washington to work. Another option is dedication of a special staff to work with outside analysts while maintaining the anonymity of the data. In any case, she stated, "privacy must be respected".

Mr. Ausubel raised the issue of the separation between data collection and policy analysis functions, such as NSF has done. Dr. Norwood said that some policy related analysis always has to be done, but that BLS will not recommend positions for clients to take on legislation. In some cases, where existing data are inadequate, BLS will undertake a survey of the literature of existing studies and report the balance of the findings, without endorsing them.