Early Childhood Longitudinal Study: Kindergarten Class of 2010-2011 – Sample Design Issues

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Abstract
The Early Childhood Longitudinal Study, Kindergarten Class of 2010-2011 (ECLS-K:2011) is the second longitudinal study of kindergartners sponsored by the National Center for Education Statistics. As with the 1998-99 cohort study, it will provide national data on children's characteristics as they progress from kindergarten through the fifth grade, as well as information on key analytical issues such as school readiness and transition from kindergarten to subsequent grades. Unlike the 1998-99 study where data were collected every other year after first grade, the 2011 study aims to collect information about the sampled children at every grade after kindergarten. In this paper, we discuss the sample design, describe school sampling frames, present procedures adopted to improve the school coverage, and discuss deviations from the 1998-99 sample design. The difficulty of implementing the sample – the recruitment of schools and parents – will also be presented in comparison with the 1998-99 study.

Key Words: longitudinal survey, multi-stage sampling, oversampling, sample coverage, sample attrition

1. Introduction

The Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K:2011) is sponsored by the U.S. Department of Education, National Center for Education Statistics (NCES). It is the third study in the Early Childhood Longitudinal Study series and the second study that begins with kindergarten (the first study, the ECLS-K, followed the cohort of children who were in kindergarten in 1998-99). The ECLS-K:2011 will provide national estimates on children's characteristics, their school readiness, transition from grade to grade, school performance, and cognitive growth. The ECLS-K:2011 plans to collect data every school year from kindergarten through fifth grade, unlike the 1998 ECLS-K, which did not have data collections in the second and fourth grades.

The ECLS-K:2011 is a nationally representative sample of approximately 20,000 children enrolled in about 900 kindergarten programs beginning with the 2010-11 school year. During this school year there were two data collections: one at the beginning (fall) and one near the end (spring). Thereafter, most follow-up studies will be conducted in the spring, beginning with spring 2012. In the fall of 2011, when most sampled students will be in first grade, data will be collected for a 30 percent subsample of the students. The same subsample will be followed up in the fall of 2012 when most sampled students will be in second grade. The fall data collections will provide information to assess growth over the summer vacations. In each administration, data collection will consist of direct

assessments of the students, interviews with their parents, and self-administered questionnaires completed by school administrators, teachers and child care providers.

In the children's kindergarten year, referred to as the base year, the sample of children was selected using a multi-stage probability design. In the first stage, the country was divided into primary sampling units (PSUs), or geographic areas that are counties or groups of counties, and 90 PSUs were sampled for inclusion in the study. In the second stage, samples of public and private schools with kindergarten programs were selected within the sampled PSUs. Both PSUs and schools were selected with probability proportional to measures of size. We built the oversampling fraction of Asians and Pacific Islanders (APIs) into the measure of size (estimated counts of children) and used this measure of size in the probability selection, thus giving PSUs and schools with a high proportion of APIs a higher chance of being selected. In the third stage, children in kindergarten and five-year–old children in ungraded schools or classrooms were selected within each sampled school, again with oversampling of APIs.

In this paper, we discuss the method of sampling PSUs, schools within PSUs, and students within schools. The school sampling frames are described, as well as procedures adopted to improve the school coverage, separately for public, Catholic and non-Catholic private schools. We also present the results of the sample implementation during the first two data collection rounds.

2. Sample Design

The primary focus of the analysis of the ECLS-K:2011 data will be at the student level, as reflected in the issues of interest such as school readiness and transition to kindergarten and subsequent grades. The optimal sample design for student-level estimates is to sample students with probabilities that are approximately the same for each student. In most studies, this is achieved by sampling PSUs and schools with probabilities proportional to the number of students and selecting a fixed number of students per school. Such a sampling procedure is used for the ECLS-K:2011.

In the base year, the design for the ECLS-K:2011 involves a first-stage sample of 90 PSUs that are counties or groups of counties, a second-stage sample of schools selected to yield 720 public and 180 private schools from the sampled PSUs, and a final-stage sample of about 23 students from each sampled school. Since this is a cohort study, students will be followed as they move to first grade and beyond, with subsampling of students who move out of their original sampled schools. The number of study schools in the subsequent years is expected to be substantially larger than the number in the base year because of this migration. The clustered design is necessary to limit the costs of data collection that are highly related to the dispersion of the children. Subsampling of movers is also done to limit the costs of data collection; it is relatively more costly to assess children who change schools because their new schools must be recruited into the study and data collection staff must visit the child's new school to conduct just one assessment.

2.1 Precision of the Estimates

An objective of the ECLS-K:2011 is to obtain a minimum level of reliability for estimates pertaining to analytical subgroups. Specifically, the subgroups are: Asian and Pacific Islanders (APIs), Blacks, Hispanics, private school kindergartners, and language minority students. Four precision requirements for the survey formed the basis for the

base year sample design and plans for the followups in subsequent rounds. These requirements are the ability to do the following:

- Estimate a proportion for each wave with a coefficient of variation (CV) of 10 percent or less;
- Estimate a mean assessment score for each wave with a CV of 2.5 percent or less;
- Measure a relative change of 20 percent in proportions across waves; and,
- Measure a relative change of 5 percent in mean assessment scores across waves (i.e., a change in means of 0.25 standard deviation).

These precision requirements involve estimating changes over time and estimating the precision of estimates in the grade 5 data collection. The assumptions used to compute the sample size were: a two-tailed test of differences with significance level alpha of 0.05 and power (beta) of at least 80 percent; estimating proportions of 30 and 36 percent (i.e., 20 percent relative change); a correlation between assessment scores from different waves of 0.6; and a design effect of 2.0.

The sample size was determined by first solving for the sample size needed under simple random sampling with 100 percent overlapping samples between waves using the formula:

$$n = \frac{\left[z_{1-\alpha/2}\sqrt{2(1-\rho)\bar{P}\bar{Q}} - z_{1-\beta}\sqrt{P_1Q_1 + P_2Q_2 - 2\rho\left(P_1Q_1P_2Q_2\right)^{1/2}} \right]^2}{\left(P_2 - P_1\right)^2},$$

where n is the sample size per wave, α is the significance level, β is the power term, z has the standard normal distribution, ρ is the correlation between two waves, P_1 and P_2 are the two proportions being compared, $Q_1 = 1 - P_1$, $Q_2 = 1 - P_2$,, $\bar{P} = \frac{P_1 + P_2}{2}$, and $Q = 1 - P$. Using these assumptions, a grade 5 sample size of about 10,300 students would be adequate to meet the precision requirements overall and for most subgroups.

To ascertain the sample size needed at the base year, we worked backward from the 10,300 sample size needed at grade 5. Based on the results of the 1998 ECLS-K study, we made assumptions regarding the rates at which students move from the base year sampled school to other schools, the rates at which the movers will be subsampled, the rates at which the subsampled movers will be located, and student completion rates. Using these assumptions, we calculated that a base year sample of approximately 20,000 kindergartens was desired.

2.2 The PSU Sample

2.2.1 PSU frame

The starting point for forming the ECLS-K:2011 PSUs was the 3,141 counties in the United States. The county-level frame was updated with Census Bureau estimates of the 2007 population and estimated counts of 5-year-old children by age and race/ethnicity for each county in 2007 (these were the latest available at the time the PSUs were created). At the county level, estimates that included race/ethnicity and age were reported in five-

year groups, rather than single year of age; thus, the number of 5-year-olds was estimated by dividing the total number of children in the 5-to-9 age group by five.

The 2007 Census estimates were compared to estimates from the 2007 American Community Survey for the 788 counties for which both ACS data and Census estimates were available. This comparison showed that the two results were similar for most subgroups except for the American Indian/Alaskan Native (AIAN) and the "other race" groups. The largest differences in the estimates are for the AIAN group and these were attributed to small ACS sample sizes with large sampling errors. The difference in the estimates for the "other race" group was due to the difference in how Census and ACS define their "other race" category. Census estimates for this category include the multi-race population and the other race groups, while ACS estimates include only the other race groups.

2.2.2 PSU formation

The objective in forming PSUs was to maximize the within-PSU heterogeneity on the variable percent black and percent Hispanic, subject to the constraints:

- that a minimum measure of size is 380 five-year-olds in the PSU;
- that a maximum distance is 100 miles between the farthest points within a PSU;
- that a PSU consists of either all MSA or all non-MSA counties; and,
- that a PSU is formed within a state boundary.

These constraints were relaxed in the following circumstances:

- In 9 PSUs we had a minimum measure of size less than 380 (ranging from 156 to 342). These PSUs could not be combined with any other PSUs because they were non-MSA PSUs that were only adjacent to MSA PSUs.
- In sparsely populated areas, either the distance within a single county was greater than 100 miles, or when we combined counties to reach of minimum MOS, the PSU distance was greater than 100 miles.
- One county was combined with another one county in an adjacent state; these two counties belong to the same MSA, and, more importantly, the first county is surrounded by all non-MSA counties and therefore could not be combined with any other MSA county in that state.
- In the case of two large MSA PSUs, the PSUs were divided into two, with one PSU containing a city and the other PSU containing the remaining areas within the PSU. The 2007 population estimate for the PSU containing the city was obtained from the Census place-level file; the estimate for the PSU without the city then was obtained by subtraction.

Table 1: Number of PSUs by MSA Status and Census Region

Region	*Non-MSA*	*MSA*	*Total*
Northeast	74	119	193
Midwest	268	206	474
South	466	358	824
West	126	97	223
Total	934	780	1,714

2.2.3 Measure of size

The PSU measure of size (MOS) was based on the estimated number of 5-year-old children in the PSU (rather than the PSU population size). The MOS also took into account an oversampling of API (Asian or Pacific Islander) children. The weighted measure of size was calculated as follows:

$$MOS = r_{API} \times n_{API} + n_{other}$$

where r_{API} is the oversampling rate for APIs and n_{API} and n_{other} are the counts of 5-year-old APIs and all other 5-year-olds, respectively. The value for r_{API} was 2.5, meaning that API children were sampled at a rate 2.5 times higher than non-API children. This oversampling rate will allow us to achieve the target number of completed API completes at the end of the fifth grade.

2.2.4 Stratification

PSUs with a large measure of size were included with certainty. To identify certainty PSUs we computed a cutoff value by dividing the sum of measures of size across all PSUs in the frame by the number of PSUs to be selected (90). Any PSU with an MOS that was 75 percent or more of the cutoff value was identified as a certainty PSU. This process yielded 10 certainty PSUs.

Once the certainty PSUs were identified, the remaining PSUs were grouped into 40 strata. PSUs were grouped to minimize the between-PSU variance within strata, while attempting to make the 40 stratum population sizes approximately equal. The variables used to create sampling strata were MSA/non-MSA, PSU measure of size, race/ethnicity (percent API, Black or Hispanic), and per capita income. All variables come from the 2007 Census data except for per capita income from the 1999 Census data. Table 2 shows the numbers of strata by MSA status and census regions.

Table 2: Number of Strata by Census Region and MSA Status

Region	*Non-MSA*	*MSA*	*Total*
Northeast	1	7	8
Midwest	2	7	9
South	3	12	15
West	1	7	8
Total	7	33	40

2.2.5 PSU selection

Two PSUs were selected in each non-certainty stratum using Durbin's Method 1 (Durbin, 1967). This method selects two first-stage units per stratum without replacement, with probability proportional to size and with known joint probability of inclusion of the pair. The Durbin method was used because it allows selection without replacement with known first and second order probabilities.

The Durbin method requires two passes of the frame with a different selection probability at each pass to obtain the desired probabilities of inclusion and joint probabilities of inclusion. In the first pass, one PSU in the stratum is selected with probability p_1. In the second pass, the selected PSU is excluded and another PSU is selected with probability proportional to

$$p_2\left[\frac{1}{1-2p_1}+\frac{1}{1-2p_2}\right]$$

where $p_1 = M_1/M$ and $p_2 = M_2/M$, M_1 is the measure of size of the first unit, M_2 is the measure of size of the second unit, and M the measure of size of the stratum.

The overall selection probability of unit i is

$$p_i = \frac{2M_i}{M}, \quad i = 1,2$$

The joint probability of inclusion of the first and second units is

$$\pi_{1,2} = \left[2p_1p_2\left(\frac{1}{1-2p_1}+\frac{1}{1-2p_2}\right)\right] \div \left(1+\sum_{k=1}^{N}\frac{p_k}{1-2p_k}\right)$$

2.3 The School Sample

2.3.1 Original school sample

In the second sampling stage, public and private schools offering kindergarten programs or educating 5-year-olds in an ungraded classroom were selected. The target number of schools was set at 720 public and 180 private schools from within the sampled ECLS-K:2011 PSUs. The number of schools selected is the target number of schools adjusted upward by expected school response and eligibility rates. In total, 1,036 public schools and 283 private schools were selected with probability proportional to the measure of size described below with the intent of attaining the targeted number of participating schools.

The school frame for the ECLS-K:2011 was built using the 2006-07 Common Core of Data (CCD) and the 2007-08 Private School Survey (PSS). The constructed ECLS-K:2011 school frame included 11,174 public schools and 6,411 private schools with kindergarten programs within the sampled PSUs. The school frame was augmented to include schools that are operational but were not included in the frame, as discussed in Section3.

Schools were selected with probability proportional to size. The measure of size was constructed taking into account the oversampling of APIs, separately for public and private schools. The measure of size for school j in PSU i was

$$SCHMOS_{ij} = 2.5 \times n_{API,ij} + n_{other,ij}$$

where 2.5 is the oversampling rate for APIs, $n_{API,ij}$ and $n_{other,ij}$ are the counts of API kindergarten students, and all other kindergarten students, respectively, in school j of PSU i.

Schools with fewer than 23 students (public) or 12 students (private) were clustered together within PSUs in order to obtain a sample that is closer to self-weighting. For example, if a public school with 12 students was not clustered, the students from that

school would be sampled at about half the probability as students in larger schools. The goal was to group small numbers of schools to form heterogeneous clusters with an aggregate number of students as close to 23 as possible. This goal was set so that if a cluster was selected we would not need to recruit many small schools; furthermore, the heterogeneity of schools improves the reliability of the estimates. We defined heterogeneity for public schools by school size and for private schools by religious affiliation and school size.

The schools were stratified implicitly within each PSU. For public schools, clusters of schools were sorted by the measure of size and separated into three size classes of roughly equal size (high, medium, and low). Within each size class, they were sorted by the proportion of APIs in a serpentine manner (i.e., from smallest to largest for the first size class, then from largest to smallest in the next size class and back to smallest to largest in the third size class). In private schools, each cluster was identified as religious, non-religious, or mixed. The list of clusters was then sorted by these three categories. Within each category, clusters were sorted in a serpentine manner by the measure of size.

2.3.2 School substitution

During the early phase of school recruitment, we realized that the school cooperation rate was lower than the rate we used to inflate the sample of schools (anticipating nonresponse), leading to a decision to select replacement schools. The general rule that we used to identify a PSU where school substitution was to take place was whether more than half of the sampled public schools in that PSU were identitifed as either initial or final refusals.

In selecting substitute schools we first had to determine whether there was a sufficient set of replacement schools in the PSU. After removing the schools in districts that refused to have any of their schools participate, we then evaluated the number of available replacement schools in each PSU. If the PSU had a sufficient number of available replacement schools, within-PSU substitution was done. If there was an insufficient number of available replacement schools in the original PSU, we identified a similar PSU in which to select replacement schools.

NCES Standards require that the replacement or substitutes be identified at the time of sampling. For this survey, this was accomplished most directly when we were able to perform within-PSU substitution. In this case, the replacement schools were selected based on the sort order used in the original sampling procedure and the school most adjacent to the original school was chosen as the replacement school. If more than one school was equally adjacent, the school whose measure of size was closest to the original school was selected. This is equivalent of pre-selecting replacement schools from a sorted frame, but concentrating only in low responding PSUs.

When within-PSU substitution was not possible, we selected substitute PSUs from the same sampling strata as the original PSUs. Within each sampling stratum, the PSU that most closely matched the original PSU on important sampling characteristics (PSU size, income, percent Black, percent Hispanic, and percent Asian) was selected. This procedure is again equivalent to a pre-selection scheme. The schools in the substitute PSUs were then combined with the sampled schools from the original PSUs. From this combined set, schools were sorted first by three size levels (small, medium, and large). In most cases this definition matched what was done for the original PSU. However, due to differences in school level characterics across orginal and substitute PSUs, there were a

few instances where this definition was modified slightly in order to provide enough donors within the size category. After assigning size categories, substitution was done within each size category after the schools were sorted in a serpentine manner based on selected school characteristics. The most adjacent school with the most similar measure of size was selected as the replacement school.

In the small PSUs, replacement schools represent 2 percent of all participating schools. In the large PSUs where the district refused to cooperate, replacement schools represent 5 percent of all participating schools. School response rates will be computed for both the original sample (before substitution).

2.4 The Student Sample

In the third stage, 23 kindergartners or 5-year-olds in ungraded classrooms were selected for the study in each school. If the school did not have 23 kindergartners, then all the kindergartners in the school were sampled. API students were oversampled using by a factor of 2.5.

The student sampling was implemented by creating two independent sampling strata: one contained a list of API kindergartners, and the other listed all other kindergarten students in the school. As noted above, API students were sampled from the API stratum using a sampling rate that was 2.5 times the rate of sampling non-API students. Within each stratum, students were selected using equal probability systematic sampling. In the schools with smaller numbers of either API kindergartners or kindergartners in general, the oversampling by API was less effective. For example, when all kindergartners were sampled there was no oversampling.

3. Improving Coverage of Schools

The sampling frames used for the main sampling of schools offering kindergarten programs were somewhat dated relative to the time at which we needed to sample. As a result, the survey augmented the frame to include newly opened schools and kindergarten programs that were not on the frame. Procedures for this freshening of the frames were different for public schools, Catholic schools and non-Catholic private schools.

New public and Catholic schools were identified by searching the websites of school districts and Catholic dioceses. The websites of these higher level organizations generally include descriptive information about all their schools, including those recently opened. Only school districts and dioceses that fell into the sample after school sampling were included in the search. In total, 194 new public schools and 52 new Catholic schools were identified in this freshening process.

For non-Catholic private schools a different procedure was used because these schools are not organized in the same way as public and Catholic schools. The 2009 QED file (a commercially available frame of schools) was used to identify non-Catholic private schools offering kindergarten programs that were not already in the ECLS-K:2011 frame. Review of the QED file yielded 615 new private schools.[1]

[1] In the 1998 study, the PSS frame did not include schools that terminated in kindergarten, and most of the new schools added to the frame that came from QED were terminal-kindergarten schools. This is not the case for the ECLS-K:2011 as the PSS now include schools ending in kindergarten.

Schools were sampled from the augmented list and added to the original school sample. In total, we added 33 new schools of which 16 are public, 4 are Catholic, and 13 are non-religious private schools.

4. Sample Implementation

Cooperation issues loom large in every major school-based survey today because of the demands placed upon the schools for information. For ECLS-K:2011, there are a number of challenges, some of which are unique to this survey because of its comprehensive nature. The hierarchy of states, districts, and schools can be difficult to negotiate, especially for a survey or assessment program that is not mandatory. In recent years, the demands of required testing have made it more difficult to obtain non-instructional time for voluntary studies like the ECLS-K:2011. As a result, districts and schools are increasingly less likely to cooperate. The cooperation issues in ECLS-K:2011 are even more difficult because of the demands from other parts of the educational system. Teachers are heavily burdened and often reluctant to spend time on non-teaching activities. Parents are increasingly skeptical about the value of surveys and non-required tests for their children. Finally, there is an additional burden associated with a longitudinal survey. The base year must pave the way for concerted followup efforts in later rounds by collecting high quality respondent contact data to maintain cooperation and track movers.

We began by notifying states and districts and dioceses about their schools' selection for the study. During fall 2009, informational materials were mailed to state Departments of Education addressed to the Chief State School Officers, State Testing Directors, and State Directors of Early Childhood Education (when identified). These materials included a welcome letter signed by NCES's Acting Commissioner as well as other materials with information about the study and its components and a list of the sampled districts within the state. Senior management staff at NCES contacted State Superintendents and State Test Directors by telephone to inform them about the study and ask if they had any questions or concerns. In some instances, Superintendents or Test Directors were asked for assistance in recruiting sampled districts in their states to participate. After the telephone contacts by NCES, a similar informational package was mailed to public school districts and Catholic dioceses with schools in the ECLS-K:2011 sample. These materials were addressed to Superintendents and any identifiable District Testing Directors and Directors of Early Childhood Education. At the same time as districts and dioceses were contacted by mail, non-Catholic private schools sampled for the ECLS-K:2011 also received an informational package. Experienced, trained Westat field staff began contacting non-Catholic private schools to secure their cooperation in fall 2009. During winter 2010, informational materials were sent to schools as districts and dioceses gave permission for their schools to be contacted. At that point, field staff made telephone contacts directly with schools.

In the base year of the ECLS-K:2011, about 7 percent of the sampled schools were out of scope, e.g., because they were closed or had no kindergarten program. Of the original sampled schools that were in scope, slightly over 60 percent cooperated.[2] For the first ECLS-K study, the school cooperation rate for the base year was 75 percent.

[2] Data for the base-year data collection are currently being processed. Therefore, estimates presented in this paper are preliminary and subject to change.

4.1 Obtaining Parent Cooperation

Another factor impeding cooperation was the high percentage of schools that required a signed parent consent form prior to allowing their children to participate in ECLS-K:2011. Schools typically require one of two types of consent: parent notification, where consent is implied unless parents opt out of the study by returning a form refusing participation, and active consent, which requires that parents opt into the study by returning a signed form giving explicit consent for their child to participate. Seventy percent of cooperating schools required signed parent consent forms; this was a 20 percentage point increase in the signed parent consent form rate from the first kindergarten cohort study. The level of effort required to gain cooperation is significantly greater when a signed parent consent form is required (signed consent forms have to be obtained from parents before the assessment day, which often requires repeated contacts from field staff to remind parents to return the forms) compared to when schools require only that parents be notified (follow-up with parents to obtain forms is not required). The requirement to obtain signed parent consent also depresses the child assessment response rate because children cannot be assessed without a signed form. In the base-year fall data collection period, we obtained parent consent (either type) for 87 percent of the sampled children. There was a 10 percentage point difference in the rate of consent obtained between schools requiring parent notification only (94 percent) and those requiring a signed parent consent form (84 percent).

In the ECLS-K: 2011 fall-kindergarten data collection, we completed child assessments with 87.2 percent of the eligible sampled children, which is lower than the previous ECLS-K base year fall completion rate of 89.8 percent. In the spring-kindergarten data collection, the completion rate for students is 85.5 percent. The increase in the schools requiring signed parent consent forms had a depressing effect on completion rates. Almost all of the nonresponse (94%) for the child assessment is due to parents refusing consent for their children to participate, either by actively refusing or by failing to return the consent form.

5. Discussion

The design for the ECLS-K:2011 is similar to the design for the 1998 ECLS-K. The major differences are: a smaller sample of PSUs (90 instead of 100); fewer schools in the sample (designed to yield 900 instead of 1,000 schools); a smaller number of students to sample per school (23 instead of 24).

The changes were made taking into account the experience of the 1998 ECLS-K. The 1998 survey yielded a larger than expected sample size at the end of grade 5. We assumed that reducing the number of PSUs and schools would still yield the desired target sample size for students at the end of grade 5. However, circumstances have changed and those changes have adversely affected the yield. Cooperation rates are lower than in 1998, requiring us to do more substitution of schools. The changes in parental permission form requirements also required a much greater level of effort than in the previous study and resulted in a lower cooperation rate. One of the consequences of this is that it is likely that, in the subsequent years, movers may have to be sampled at a higher rate than planned in order to not fall short of the target sample size at grade 5. This clearly has cost implications.

Another major design difference between the two studies is in the way the school frames were augmented. In the previous study, sampled school districts and dioceses were asked to provide us with lists of schools in their districts/dioceses. These lists were then compared against the school frames to find new schools in a labor-intensive activity. In the 2011 study, we opted instead to do web searches of new schools. This was not only simpler and less expensive, but it also reduced the burden on the districts and dioceses and lowered the risk of refusals. To find new non-religious private schools, we used the QED file instead of white pages, as was done in 1998. In 1998, most non-religious private schools turned out to be out-of-scope. The QED file is more up-to-date than the white pages, and gives better results.

In spite of numerous challenges, the base year sample achieved at the end of the spring data collection shows that we will achieve a base-year sample size that will satisfy the analytic needs of the study. This base-year sample will form the basis for data collection in subsequent years and will allow us to reach the ultimate target that is the sample size at the end of fifth grade.

6. Reference

Durbin, J. 1967. Design of multi-stage surveys for the estimation of sampling errors. In *Journal of the Royal Statistical Society*, London, EC1Y 8LX, England: C, 16, 152-164.