

SESUG Paper 123-2017

The %FRED Macro—Finding Risk in Education Data

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ABSTRACT

There has been increasing attention given to the analysis of the risk of students who are disproportionately represented in special education settings, such as the overidentification of students in specific disabilities and/or racial/ethnic groups who receive special education services around the country. With recently passed regulations related to the Individuals with Disabilities in Education Act (IDEA), states and local school districts must determine if new standards in disproportionality and risk will affect how they provide services to students with disabilities. The often complicated risk ratio formulas require many repetitive calculations for multiple demographic categories. This makes the issue a perfect candidate for a macro!

The %FRED macro (“Finding Risk in Education Data”) uses the SAS® macro facility along with array processing and the SAS® Prompt Manager to help stakeholders quickly and more accurately determine if their state or local school district is at risk for disproportionality based on recommended formulas for states to use. This will allow analysts in SAS® Enterprise Guide to run a robust program without having to worry about programming the calculations themselves. This paper will outline the steps from conception to completion.

INTRODUCTION

The Individuals with Disabilities in Education Act (IDEA) requires States to collect and examine data to determine if significant disproportionality is occurring based on demographic data (mainly race and ethnicity). This data must be reviewed at the State and local school district level and analyzed and must look at categories such as the identification of a student with a disabilities, specific disability categories being identified, the educational setting of students with a disability, and disciplinary actions including suspensions and expulsions. The most recent guidance from the Office of Special Education Programs of the U.S. Department of Education states that a standard methodology should be used to analyze disparities for racial or ethnic groups within each category of analysis, and that states must use a risk ratio or alternate risk ratio to comply with the regulations set forth by IDEA.

Applying a standard methodology across seven racial/ethnic groups for 14 multiples categories of analysis means that up to 98 risk ratios could be calculated *per district*. In a smaller state such as South Carolina, this could mean attempting to calculate over 8,600+ ratios to determine disproportionality across the entire state! Thus, this paper will introduce how we used SAS Enterprise Guide, SAS arrays, the SAS Macro Facility, and the Prompt Manager to solve this complex problem and provide data to stakeholders in an efficient manner.

(Note: This paper does not address whether the calculations used would be appropriate in your specific situation or address the validity of the formulas being used for disproportionality as these are public formulas used for a specific purpose. However, this can be a starting point to help users develop their own macros and programs using SAS Enterprise Guide. This paper also does not speak to, represent, or present viewpoints of the U.S. Department of Education, the Office of Special Education Programs, or the South Carolina Department of Education.)

STEP-BY-STEP DEVELOPMENT OF THE %FRED MACRO

This paper assumes that a dataset has been created with the following information for each category of analysis, along with some basic knowledge of array and macro processing:

- Variables with counts for each of the seven race/ethnicities within the category of analysis (ER01-ER07 in this paper)
- The total counts for the entire district for each of the seven race/ethnicities (TotalCountER01-TotalCountER07)
- The difference between the analysis count and the total district count (diffCC and diffTC arrays)
- The total statewide count for the category of analysis for each race/ethnic category (TotalSCCC array)
- The total student count for each race/ethnic category (TotalStudentCount array)

In order to develop the calculations for this macro, the following steps were taken:

1. Create arrays for the variables being used in the count (ChildCount) as well as for the variables used for the total count within the district (TotalCount).
2. Create arrays for the differences between the group being analyzed and the rest of the school district (diffCC, diffTC).
3. Create arrays for the counts for the entire statewide numbers to be used in the Alternate Risk Ratio calculations (TotalSCCC, TotalStudentCount).
4. Create arrays for the Risk Ratio, Alternate Risk Ratio, and a trigger to determine if data from a school district appears to show significant disproportionality.
5. Create a loop to calculate the differences needed for the Risk Ratio.
6. Create a second loop to calculate the Disability Risk, the Risk Ratio and Alternate Risk Ratio for each district.
7. Create a third loop to determine if the district's Risk Ratio or Alternate Risk Ratio would flag the district for significant disproportionality.
8. Export the report using PROC EXPORT.
9. Use the Prompt Manager to allow users to input values into the %FRED macro.

The full macro program is shown below with each of the steps highlighted (Step #9 will be in the Prompt Manager section). The %FRED macro is then run in any program after you use the appropriate PROC SQL or DATA steps to create the datasets which will provide the information for the macro to run. Each section will be explained and is color coded for easier navigation within the paper.

```
%macro FRED(CellSize, NSize, RiskRatio);
```

```
data IDDataset (drop=i);
  set FullERJoin;
```

```

1 array ChildCount{7} ER01-ER07; /* Child Count for disability category only */
2 array TotalCount{7} TotalCountER01-TotalCountER07; /* Total SPECIAL EDUCATION
3 array diffCC{7};
  array diffTC{7};
  array TotalSCCC{7} (&ER01TotalCC, &ER02TotalCC, &ER03TotalCC, &ER04TotalCC,
  &ER05TotalCC, &ER06TotalCC, &ER07TotalCC); /* Statewide SPECIAL EDUCATION count
  */
4 array TotalStudentCount{7} (&TSC01, &TSC02, &TSC03, &TSC04, &TSC05, &TSC06,
  &TSC07); /*Total GENERAL EDUCATION count */
  array DisabilityRisk{7} AIANDR TwoOrMoreDR HLDR BlackDR WhiteDR AsianDR
  NHOPIDR;
  array RiskRatio{7} AIANRR TwoOrMoreRR HLRR BlackRR WhiteRR AsianRR NHOPIRR;
  array ARR{7} AIANARR TwoOrMoreARR HLARR BlackARR WhiteARR AsianARR NHOPARR;
  array SD{7} $ 10;
  array SDARR{7} $ 10;

5 do i = 1 to 7;
  diffCC{i} = sum(of ChildCount{*}) - ChildCount{i};
  diffTC{i} = sum(of TotalCount{*}) - TotalCount{i};
end;

do i = 1 to 7;
6 DisabilityRisk{i} = ChildCount{i} / TotalCount{i};
  RiskRatio{i} = (ChildCount{i}/TotalCount{i}) / (diffCC{i}/diffTC{i});
  ARR{i} = (ChildCount{i}/TotalCount{i}) /
  (TotalSCCC{i}/TotalStudentCount{i});
end;

do i = 1 to 7;
```

7

```

        if (ChildCount{i} ge &CellSize and TotalCount{i} ge &NSize and diffCC{i}
        ge &CellSize and diffTC{i} ge &NSize) and RiskRatio{i} ge &RiskRatio then
        SD{i} = 'Yes';
        if (ChildCount{i} ge &CellSize and (diffCC{i} < &CellSize or diffTC{i} <
        &NSize)) and ARR{i} ge &RiskRatio then SDARR{i} = 'Yes';
    end;

```

```
run;
```

```
proc export data=IDDataset
```

8

```

    dbms=xlsx
    outfile="W:\SASTEST\OSES\SAS Datasets\New Sig Dispro Regs\Data\MacroTest\FRED
    &sysdate..xlsx"
    replace;

```

```
run;
```

```
%mend;
```

THE STEPS IN DETAIL

Step 1: Create arrays for the variables being used in the count (ChildCount) as well as for the variables used for the total count within the district (TotalCount).

Because of the repetitive calculations required of this exercise, arrays are the chosen solution to develop all of the risk ratios required for further analysis. Thus, most of the variables are placed into arrays, starting with the counts of the students within the category of analysis.

1

```

array ChildCount{7} ER01-ER07; /* Child Count for disability category only */
array TotalCount{7} TotalCountER01-TotalCountER07; /* Total SPECIAL EDUCATION
child count for ER category */

```

Step 2: Create arrays for the differences between the group being analyzed and the rest of the school district.

These arrays will hold the different sets of numbers required to make the appropriate significant disproportionality calculations.

2

```

array diffCC{7};
array diffTC{7};

```

Step 3: Create arrays for the counts for the entire statewide numbers to be used in the Alternate Risk Ratio calculations (TotalSCCC, TotalStudentCount).

3

```

array TotalSCCC{7} (&ER01TotalCC, &ER02TotalCC, &ER03TotalCC, &ER04TotalCC,
&ER05TotalCC, &ER06TotalCC, &ER07TotalCC); /* Statewide SPECIAL EDUCATION count */
array TotalStudentCount{7} (&TSC01, &TSC02, &TSC03, &TSC04, &TSC05, &TSC06,
&TSC07); /*Total GENERAL EDUCATION count */

```

Step 4: Create arrays for the Risk Ratio, Alternate Risk Ratio, and a trigger to determine if data from a school district appears to show significant disproportionality.

These arrays will hold the values of the risk ratios needed to determine if there is a possible finding of significant disproportionality for a school district. Notice how in the DisabilityRisk, RiskRatio, and ARR arrays, they are slightly different for the arrays in Steps 1 and 2 because the variable names have been declared to show the racial/ethnic risk ratio being calculated. They are also declared in the same order to make it easier to follow the data.

4

```

array DisabilityRisk{7} AIANDR TwoOrMoreDR HLDR BlackDR WhiteDR AsianDR
NHOPIDR;
array RiskRatio{7} AIANRR TwoOrMoreRR HLRR BlackRR WhiteRR AsianRR NHOPIRR;
array ARR{7} AIANARR TwoOrMoreARR HLARR BlackARR WhiteARR AsianARR NHOPARR;
array SD{7} $ 10;
array SDARR{7} $ 10;

```

Step 5: Create a loop to calculate the differences needed for the Risk Ratio.

5

```

do i = 1 to 7;
    diffCC{i} = sum(of ChildCount{*}) - ChildCount{i};
    diffTC{i} = sum(of TotalCount{*}) - TotalCount{i};
end;

```

Step 6: Create a second loop to calculate the Disability Risk, the Risk Ratio and Alternate Risk Ratio for each district.

The risk ratio is defined as a numerical comparison between the risk of a specific outcome for a specific racial/ethnic group in a school district (DisabilityRisk array) vs. the risk of that same outcome for all other children in that same school district (the diffCC{i}/diffTC{i} calculation). This is calculated by dividing the risk of a particular outcome for children in one racial/ethnic group within the district by the risk of the same outcome for children in all other racial/ethnic groups in the same district.

The Alternate Risk Ratio is used when the comparison group does not meet the minimum cell size or n-size that is set by the state completing the analysis. In order to complete this calculation, the comparison group is all other children in the state (versus just using the numbers within the school district being analyzed).

In the %FRED macro, these calculations are made using the loop below, and the resulting values are placed in the corresponding array:

6

```

do i = 1 to 7;
    DisabilityRisk{i} = ChildCount{i} / TotalCount{i};
    RiskRatio{i} = (ChildCount{i}/TotalCount{i}) / (diffCC{i}/diffTC{i});
    ARR{i} = (ChildCount{i}/TotalCount{i}) / (TotalSCC{i}/TotalStudentCount{i});
end;

```

Step 7: Create a third loop to determine if the district's Risk Ratio or Alternate Risk Ratio would flag the district for significant disproportionality.

This loop takes into account the user input of the variables within the macro program. In order to appropriately complete this analysis, it was determined that users should have a way to enter different numbers and ratios to best determine how each district's data and significant disproportionality determination would be affected.

Notice the macro variables within the IF-THEN statements that are highlighted below. The data is inserted into these macro variables when the full macro program is run. To create additional functionality for this program, the SAS EG Prompt Manager (step #9) is used to prompt the user for the values of the highlighted variables.

7

```

do i = 1 to 7;
    if (ChildCount{i} ge &Num and TotalCount{i} ge &Denom and diffCC{i} ge &Num and
diffTC{i} ge &Denom) and RiskRatio{i} ge &RRPrompt then SD{i} = 'Yes';
    if (ChildCount{i} ge &Num and (diffCC{i} < &Num or diffTC{i} < &Denom)) and
ARR{i} ge &RRPrompt then SDARR{i} = 'Yes';
end;

```

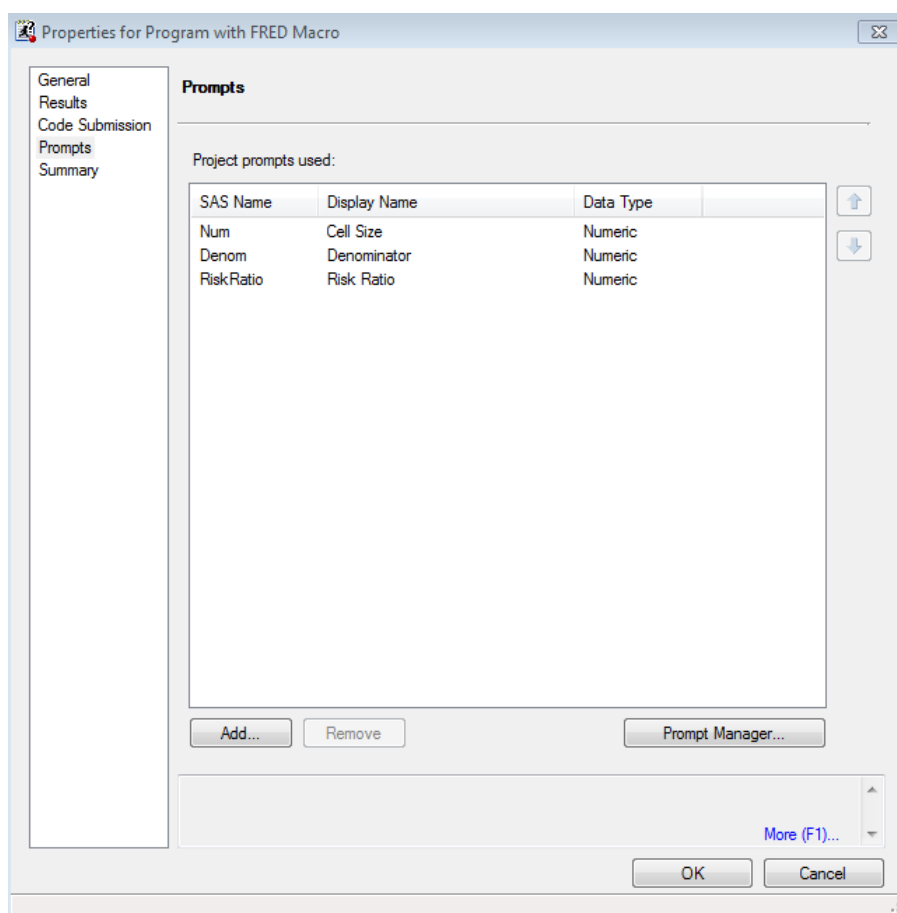
Step 8: Use PROC EXPORT to export the file into Excel.

For easy tracking, the macro variables were inserted into the OUTFILE statement. When the file is pulled up in Excel, the file name will have the values which were given by the user.

```
proc export data=IDDataset
  dbms=xlsx
  outfile="...folder for saving data...\MacroTest\FRED &CellSize &NSize
  &RiskRatio.xlsx"
  replace;
run;
```

Step 9: Use the SAS EG Prompt Manager to allow users to input values into the %FRED macro

In order to provide some additional functionality and make the program more user friendly, the SAS Enterprise Guide Prompt Manager is used to allow the user to enter the variables needed for the FRED macro. Notice how the SAS names match the macro variables in Step #7. This allows SAS to run the program and insert the appropriate data based on the user entered values from the prompts.



CONCLUSIONS

For complex problems where multiple repetitive calculations are necessary, macro and array processing provides a viable and efficient solution that can save a significant amount of time and resources. A process that make take days or weeks in Excel can now take mere seconds using this SAS macro. By saving time with the data analysis, this can help provide more time for our educational staff in our local school districts to better investigate the root causes of significant disproportionality that may be occurring for our students with disabilities.

REFERENCES

First, Steve and Schudrowitz, Teresa. "Arrays Made Easy: An Introduction to Arrays and Array Processing."
Proceedings of the SAS Users Group International 30, SAS Institute Inc. (Cary, NC), 2005.

Office of Special Education Programs, U.S. Department of Education. Significant Disproportionality (Equity in IDEA):
Essential Questions and Answers. <https://sites.ed.gov/idea/files/significant-disproportionality-ga-03-08-17-1.pdf>

CONTACT INFORMATION

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