USDA National School Lunch Program Time Series Analysis

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Contents

My Question:

My analysis seeks to explore the questions: Is there seasonality in how U.S. school food programs feed students? What about long-term trends, and how did any trends change in 2020 during school closures from the Covid-19 pandemic?

Background

The National School Lunch Program (NSLP) is an enormous food system with major implications for equity in American K-12 education systems. Every day, NSLP provides ~30 million children school lunch at free or reduced prices (1). It operates in public and nonprofit private schools and residential childcare facilities (2).

To provide meals at free and reduced cost to students, participating school districts are reimbursed cash subsidies for every qualifying meal they serve. To qualify for subsidy, meals served by Nutrition Services operators must meet federal meal pattern policies which define meal content around qualifying food group combinations, sugar content, etc.

**** something about impact of access to nutrition on student behavior and performace, with sources cited!

Data Description

The Food and Nutrition Services sector of the USDA offers monthly and annual reports of national participation in the National School Lunch Program and other school meal programs subsidized by the USDA (breakfast, seamless summer, supper, and snacks).

To answer my questions. . .

My analysis seeks to explore the questions: Is there seasonality in how U.S. school food programs feed students? What about long-term trends, and how did any trends change in 2020 during school closures from the Covid-19 pandemic?

. . . I used the National Level Monthly Data for the National School Lunch Program, which comes in PDF and Excel formats which are public. I downloaded the Excel format of the monthly data and did some tidying in Excel to make sure the .csv version would be friendly with R! There were some formatting thing like merged cells that included titles, not observations, as rows, which I eliminated before downloading as a .csv in my R project.

Even after a little manipulation in excel, there were changes to be made for easier manipulation of my monthly lunch data dataframe. Here, I give columns more descriptive names, remove odd columns that were added to the dataframe when I read in the .csv, mutate columns to exclude "%" "-" or spaces that R cannot make sense of.

Last, I make sure the class of each column is correct. All of the columns were of class `numeric` when read in, so I mutated the `month` column to `yearmon` using the `zoo` package, and everything else to numeric.

Finally, to have an initial look at my data, I make simple line graphs here:

NSLP Lunches Served (Monthly)

NSLP Free Lunches Served (Monthly)
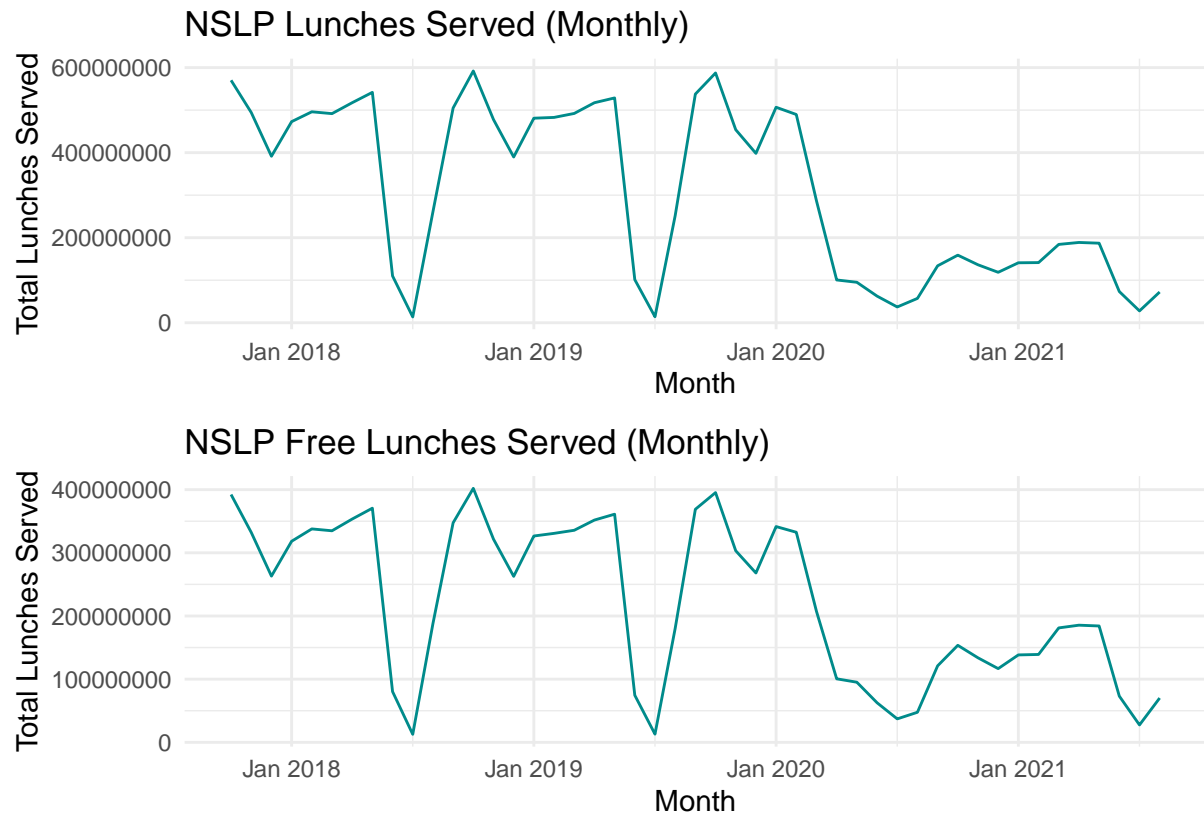
Analysis Plan

My analysis is split into two sections: one for all lunches served for the 2017-2020 SYs and one for all of the lunches served which qualified for whole reimbursement from the USDA NSLP, or free lunches. I thought it might be interesting to see if seasonality and long term trends compare between the whole group and the subgroup.

For both, I create a tsibble with the months as class `yearmonth` and the total lunches served per month, then create an additive classical decomposition model.

I then use this model to create an autoplot which helps to visualize the presence of seasolity and long-term trends in the data for both groups.

Finally, I generate an autocorrelation function with a lag of 12 because I want to see how much participation in one month is correlated with participation for the rest of the school year.
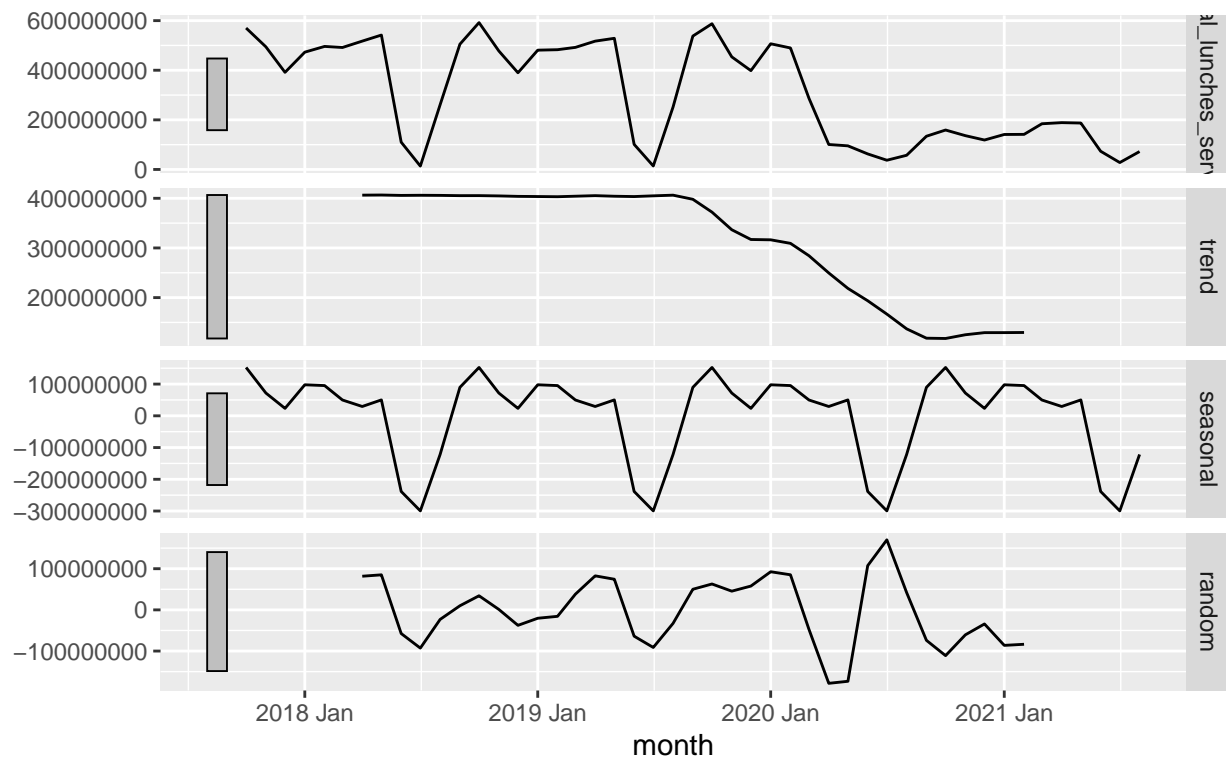
Series monthly_tsib
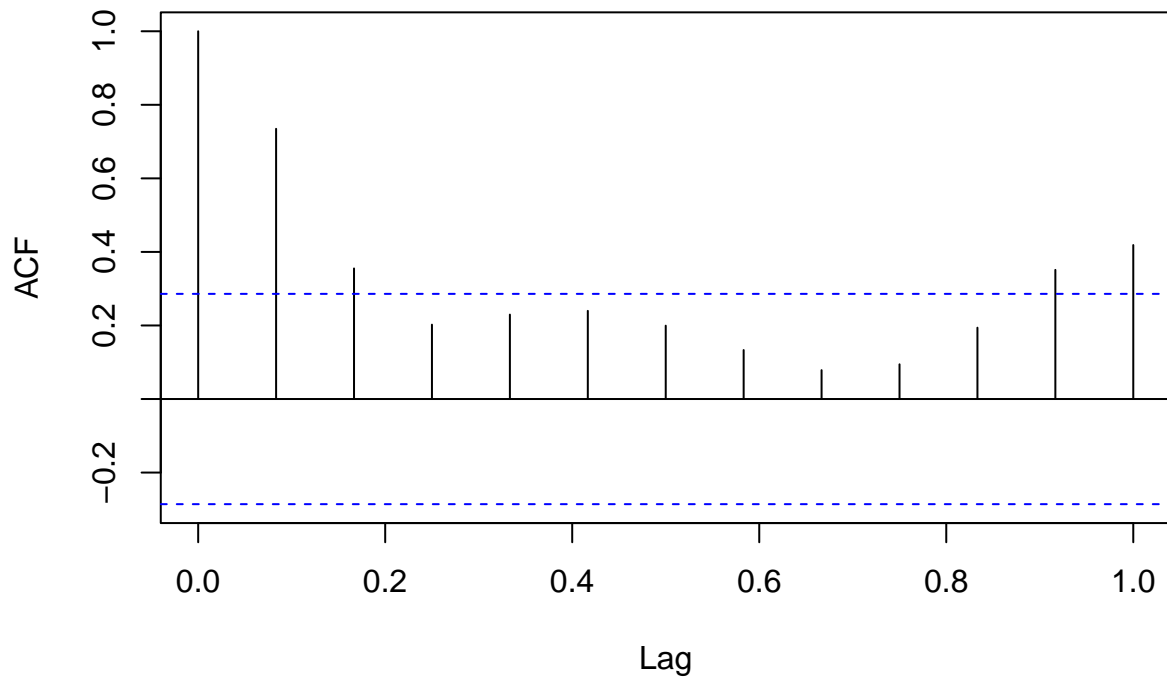
Classical decomposition

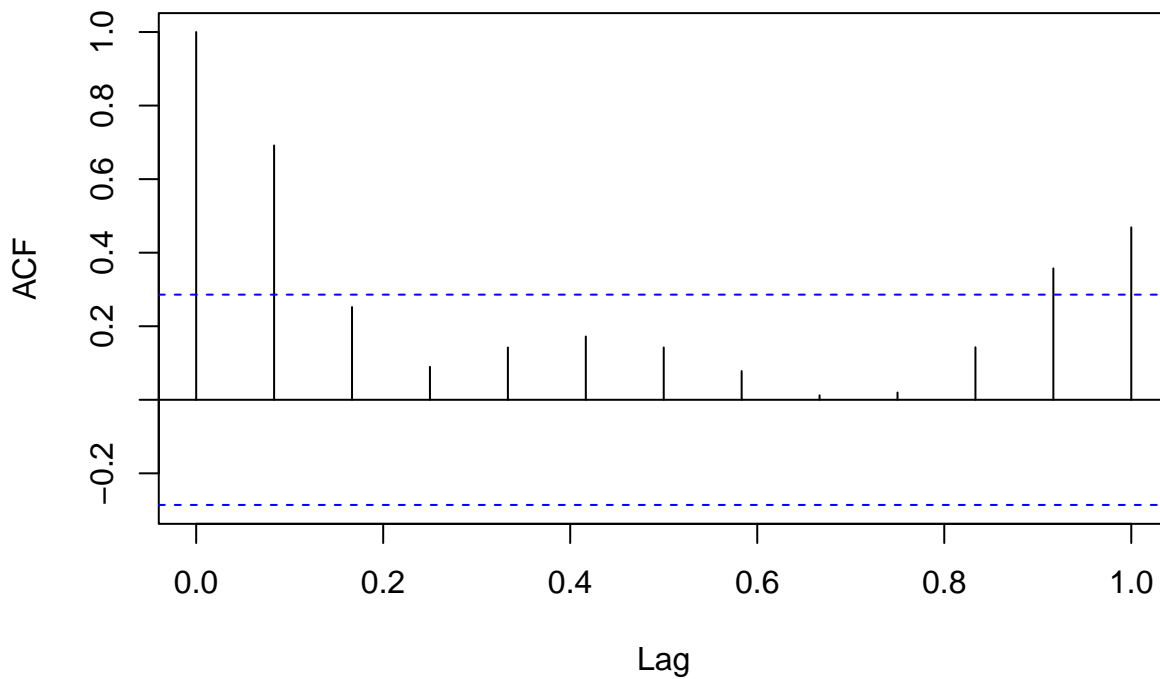total_lunches_served = trend + seasonal + random

##

```
## Autocorrelations of series 'monthly_tsib', by lag
##
## 0.0000 0.0833 0.1667 0.2500 0.3333 0.4167 0.5000 0.5833 0.6667 0.7500 0.8333
##  1.000  0.735  0.355  0.202  0.230  0.240  0.200  0.133  0.079  0.094  0.194
## 0.9167 1.0000
##  0.351  0.419
```

Participation of Free-Lunch Eligible Students

Series free_tsib

Summarize results visually and in words

Next steps and future directions

References

(1) https://www.ers.usda.gov/topics/food-nutrition-assistance/child-nutrition-programs/national-school-lunch-program/
(2) https://fns-prod.azureedge.net/sites/default/files/resource-files/NSLPFactSheet.pdf