Unpaid Lunch Debt in Durham, NC

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Introduction

When families can't afford to pay for student lunches, school districts foot the bill. But with major cuts to educational funding in North Carolina—where some schools don't even have enough funds to pay for students' textbooks—this means school districts can wrack up tens of thousands of dollars in debt. In Durham, students with five or more unpaid lunches only receive a juice and a sandwich instead of a hot lunch. This lends its way to "lunch shaming", where students who can't afford pay skip the meal altogether to avoid the embarrassment of eating a cold lunch. This is a major issue, since student performance in school is directly tied to access to quality food.

Data Sources

- End-of-Year unpaid meal data from James Keaton, director of child nutrition services at DPS.
- All free/reduced price lunch data was obtained from ncpublicschools.org
- 2010-11 through 2015-16 demographic data was obtained from the NCES ELSI table generator, code 91803
- 2017-18 ADM data from ncpublicschools.org's Average Daily Membership and Membership Last Day by School
- 2016-17, 2017-18 demographic data from Durham Public Schools

Merging Checks

We're pulling data from lots of different sources. Let's see where there may be disparities.

```
## # A tibble: 6 x 4
## # Groups:   school_no [1]
##   school_no year       mf   adm
##   <chr>     <chr>   <dbl> <dbl>
## 1 304       2010-11   721   717
## 2 304       2011-12   703   716
## 3 304       2012-13   662   653
## 4 304       2013-14   680   682
## 5 304       2014-15   671   669
## 6 304       2015-16   655   665
```

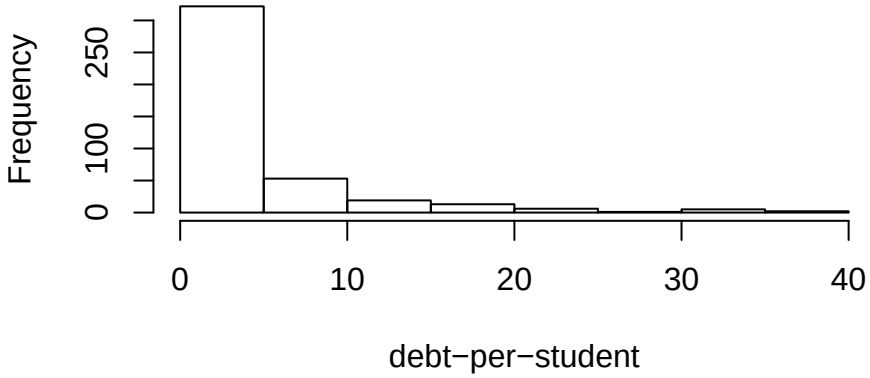
```
## [1] 397   4
```

```
## [1] 440  29
```

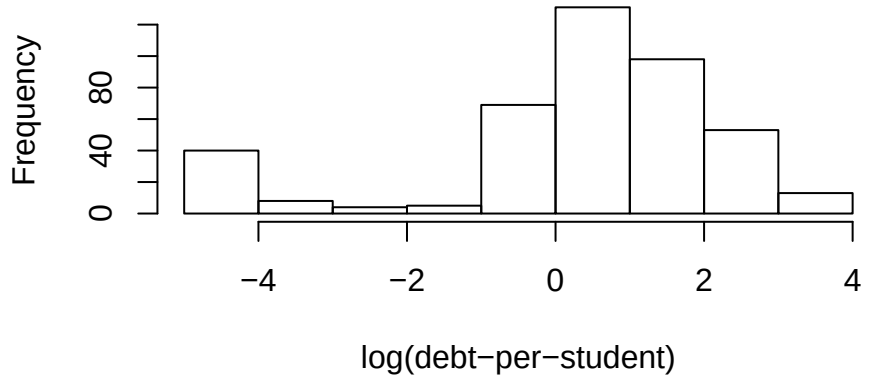
Most of our student counts don't match up by the simplest measure: comparing the total ADM, retrieved from free/reduced lunch data, to the total number of male and female students. According to KC Elander at NC DPI, this is because data is pulled at different points in time, from different government agencies and for different requests.

Exploratory Data Analysis

First, let's try to get a sense of the spread of school lunch debt in Durham County.



Our data is pretty skewed. If we want to pick up on small differences, it may be worth trying a log transformation.



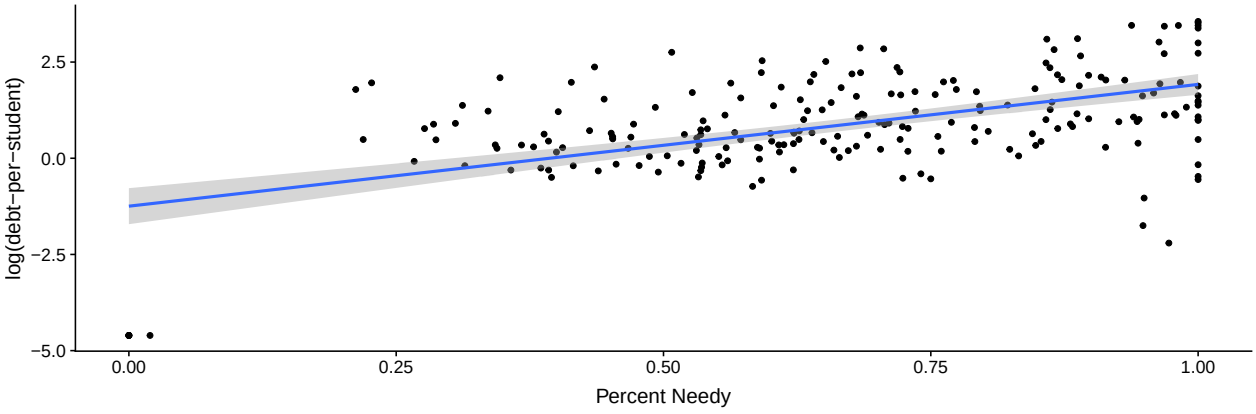
Alright, much better! Still, our data is bimodal. Let's check if the first node, centered around roughly -4, are years where a school had no debt. These may be years where are school had CEP status.

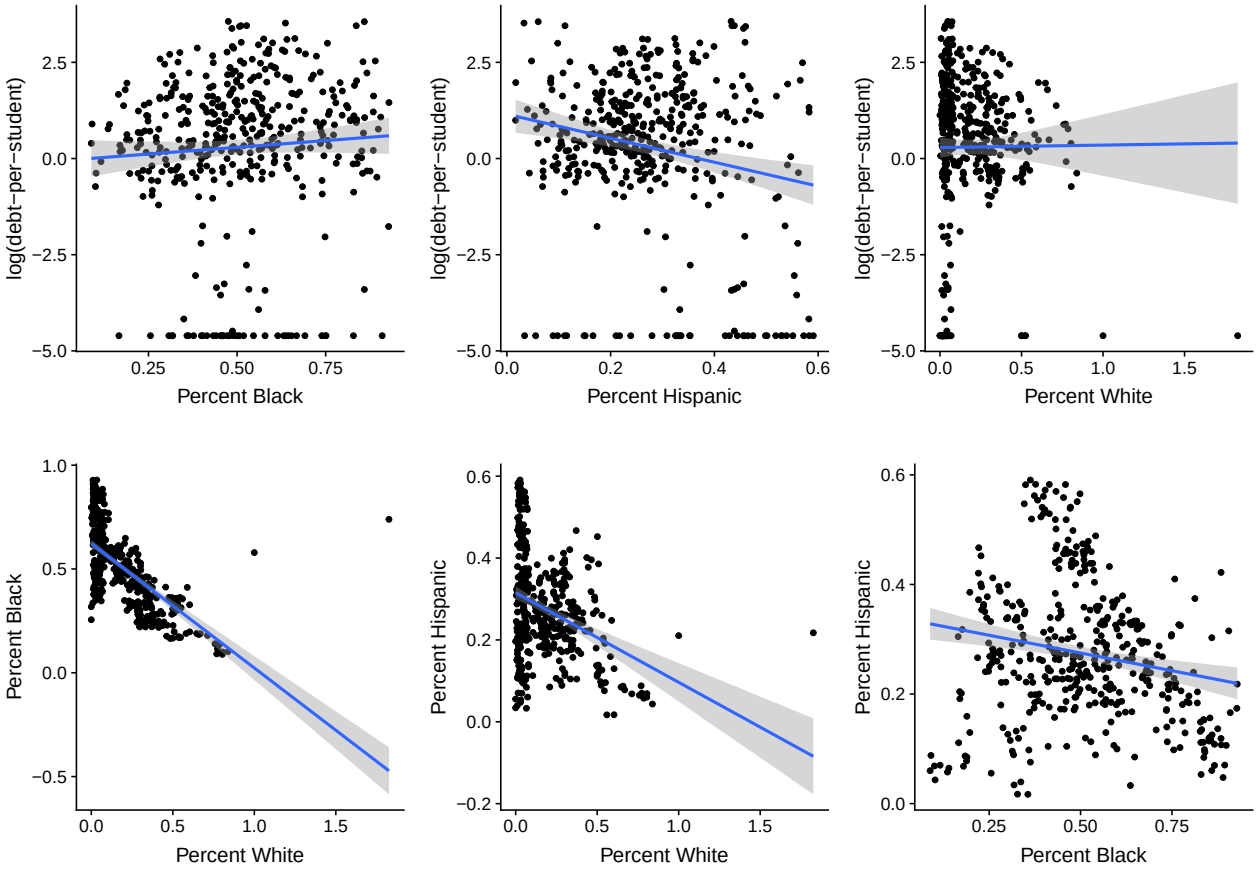
```
##    school_no    year cep
## 1        304 2016-17   1
## 2        304 2017-18   1
## 3        308 2016-17   1
## 4        308 2017-18   1
## 5        309 2017-18   0
## 6        310 2014-15   1
## 7        310 2016-17   1
## 8        310 2017-18   1
## 9        315 2017-18   1
## 10       317 2017-18   0
## 11       320 2016-17   1
## 12       320 2017-18   1
## 13       336 2010-11   0
## 14       336 2011-12   0
## 15       336 2012-13   0
## 16       336 2016-17  NA
## 17       336 2017-18  NA
## 18       339 2016-17   1
## 19       339 2017-18   1
## 20       341 2016-17   1
```

```
## 21       341 2017-18   1
## 22       343 2010-11  NA
## 23       344 2014-15   1
## 24       344 2016-17   1
## 25       344 2017-18   1
## 26       352 2016-17   1
## 27       353 2010-11   0
## 28       353 2011-12   0
## 29       353 2012-13   0
## 30       353 2014-15  NA
## 31       353 2015-16  NA
## 32       353 2016-17  NA
## 33       353 2017-18  NA
## 34       367 2014-15   1
## 35       367 2016-17   1
## 36       367 2017-18   1
## 37       369 2010-11  NA
## 38       374 2015-16   1
## 39       374 2016-17   1
## 40       374 2017-18   1
## 41       388 2016-17   1
## 42       388 2017-18   1
## 43       389 2014-15  NA
## 44       389 2015-16  NA
## 45       389 2016-17  NA
## 46       389 2017-18  NA
## 47       400 2014-15   1
## 48       400 2015-16   1
## 49       400 2016-17   1
## 50       400 2017-18   1
## 51       700 2014-15  NA
## 52       700 2015-16  NA
## 53       700 2016-17  NA
## 54       700 2017-18  NA
```

For the most part, aside from missing data, it seems like schools with no debt are CEP schools. So let's stick to our log transformation and continue our EDA.

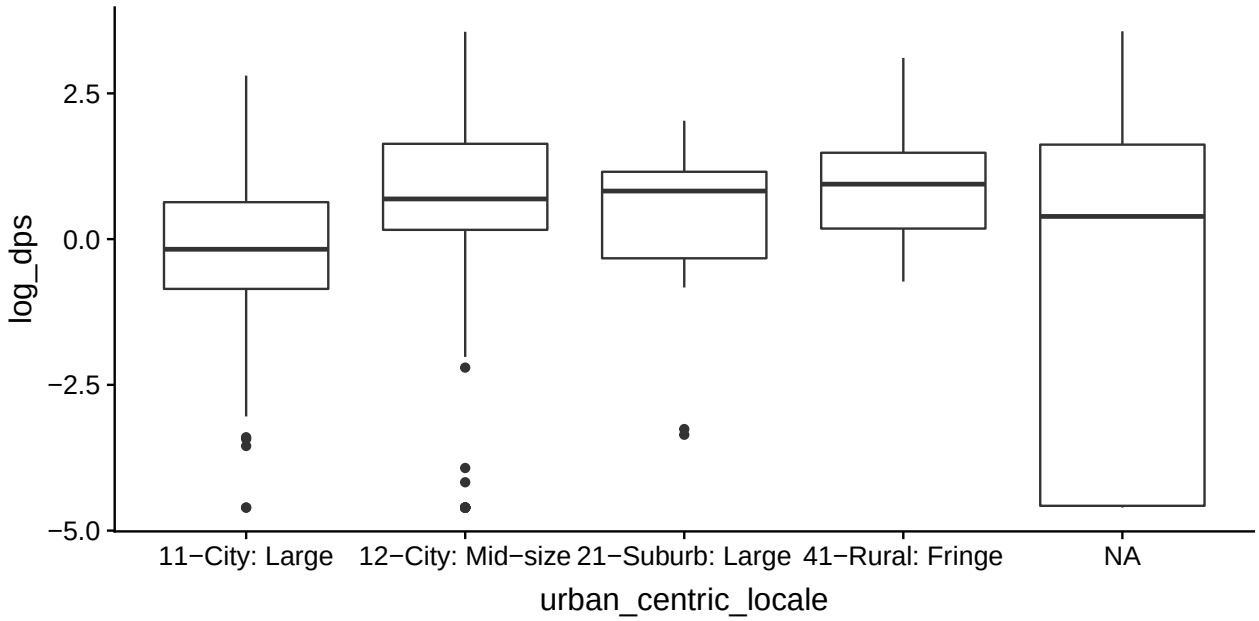
Debt and Demographics



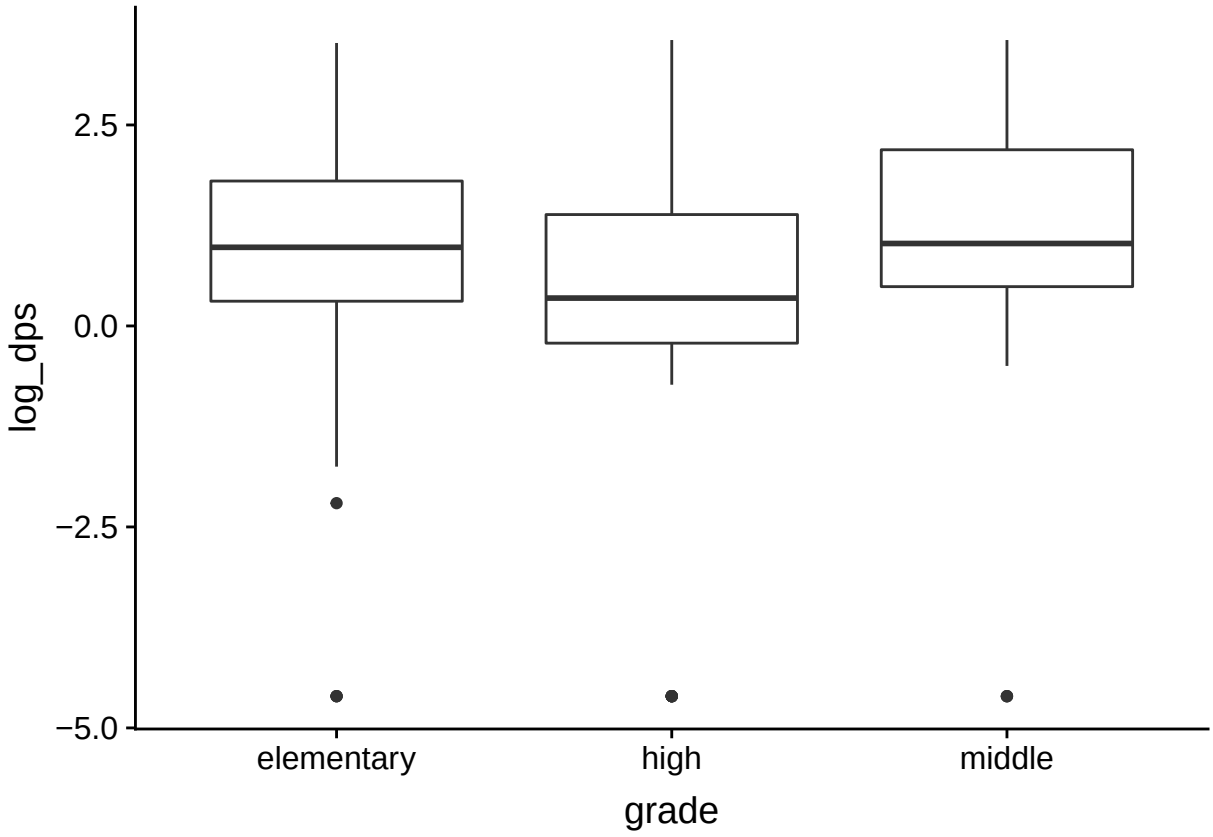


Looks like as schools become more black, they also see more debt-per-student. The same trend is there for hispanic students, but less pronounced. And when it comes to white schools, the more white students—the less debt. We're also seeing that schools tend to be segregated—there is a negative correlation between the percentage of black students and and white students, and a slightly less strong, but still negative correlation between the percentage of white and hispanic students. The percentege of black and hispanic students are positively correlated.

Debt and Locale

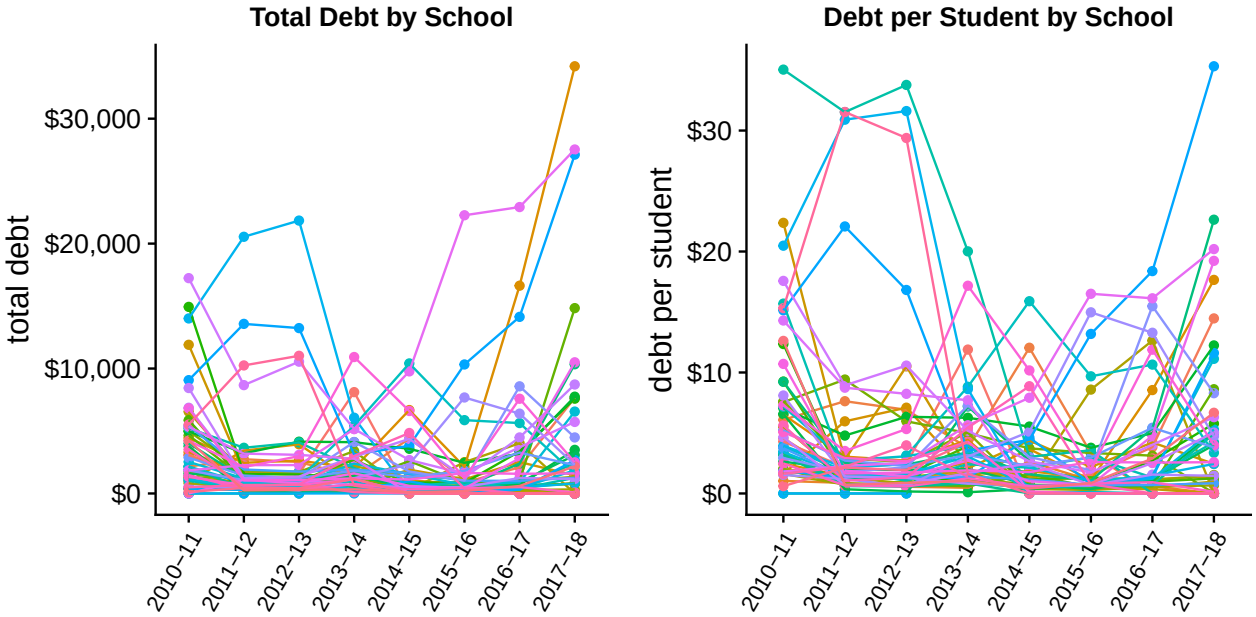


Large cities, on average, have less debt than their smaller and more suburban and rural counterparts.



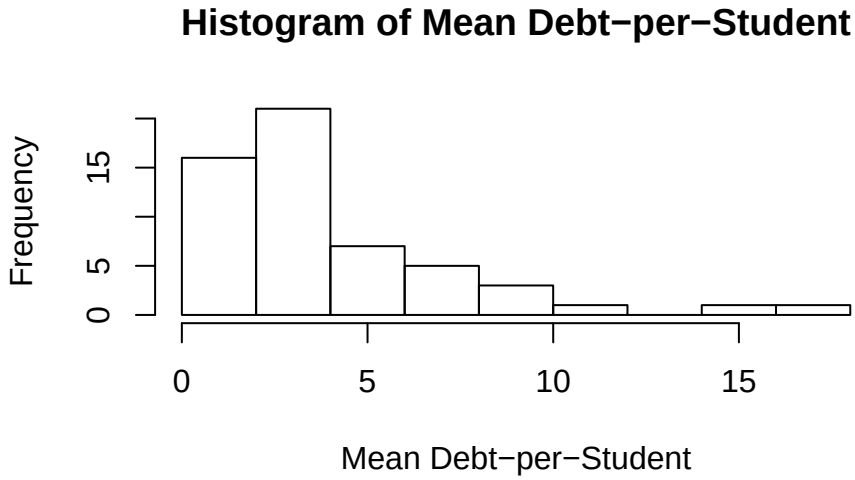
We also see that elementary and high schools tend to have more dept per student than middle schools.

Longitudinal look at debt from 2010-11 through 2017-18

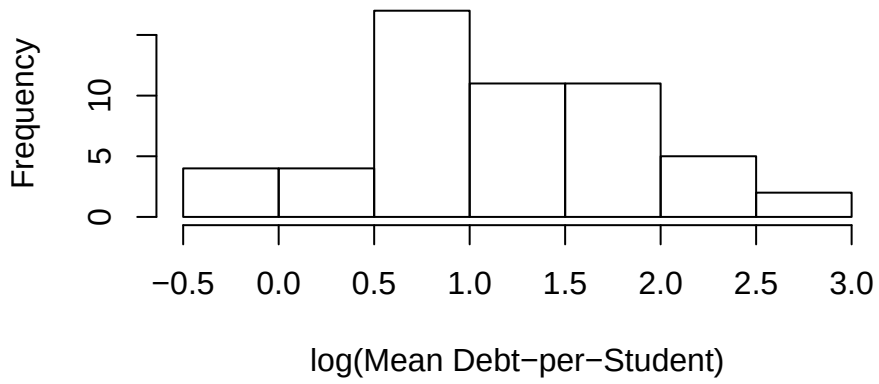


There's a lot of fluctuation in total debt and debt-per-student across all schools, so I'll try to find the "most extreme" schools using a few measures. But first, let's take a look at the spread of our data.

The first is simple: Let's see which schools, on average, have the highest debt.



The data is not normally distributed. Let's try a log transformation.



A log transformation makes this data much more normalized. Let's use this to grab find outliers in the data based on Z-scores.

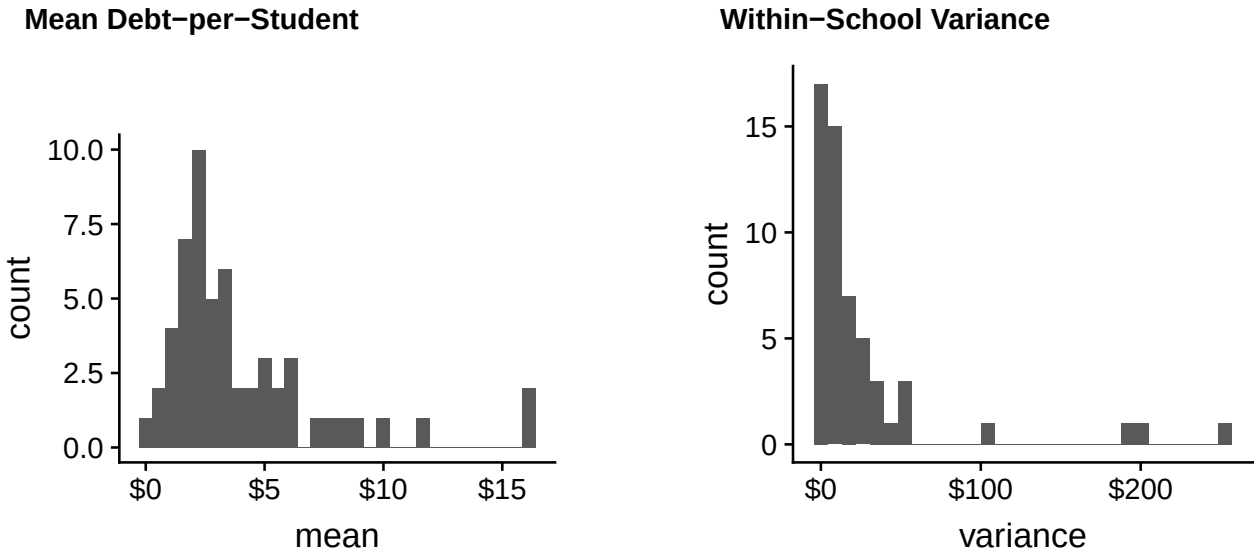
After normalizing the data with a log transformation, there aren't any schools that seem to be outliers in terms of their mean debt-per-student, except for 353 (Middle College High School), which typically has *less* debt than the rest of public schools. What's different about this school?

```
##      year adm unpaid free reduced cep
## 1 2010-11  92    0.0    0       0   0
## 2 2011-12 101    0.0    2       0   0
## 3 2012-13 104    0.0    0       0   0
## 4 2013-14  NA    4.3   NA      NA  NA
## 5 2014-15  NA    0.0   NA      NA  NA
## 6 2015-16  NA    0.0   NA      NA  NA
## 7 2016-17  NA    0.0   NA      NA  NA
## 8 2017-18  NA    0.0   NA      NA  NA
```

Hm. Seems like we're missing a lot of data. I'll get back to that later.

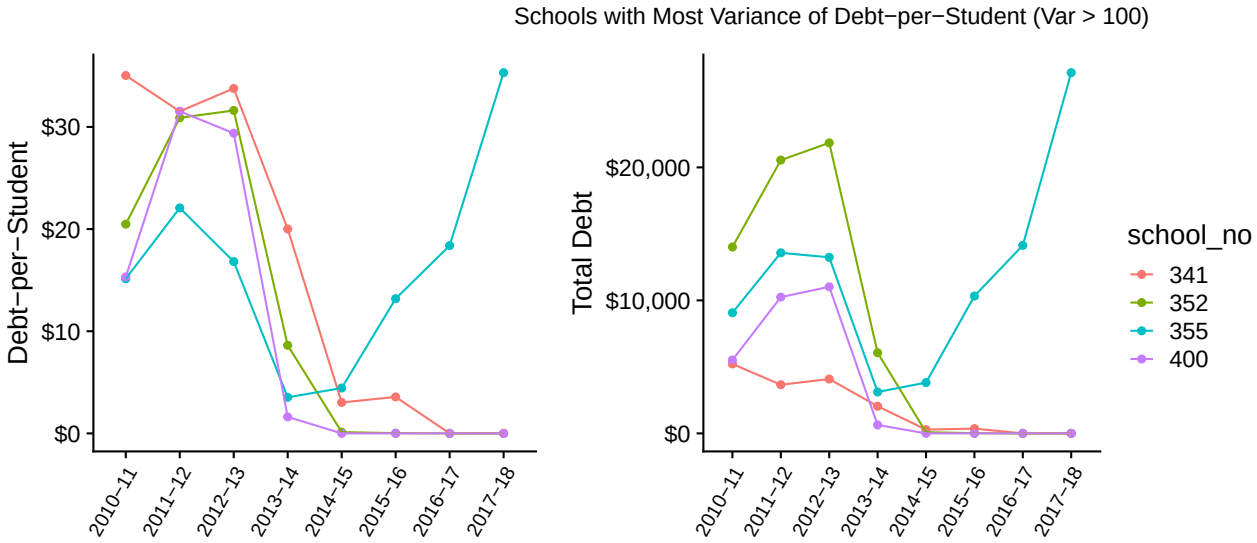
Mean and variance of debt within schools

I also looked at the mean and variance of debt per student by school. This gives us a sense of *how* much debt per student fluctuates within in each school. Schools with a high variance should be looked into—perhaps fluctuations in debt are tied to CEP status? Or someone bailing a school out of debt? Similarly, schools with a generally high mean debt per student are of interest. Why are these schools struggling more than others?

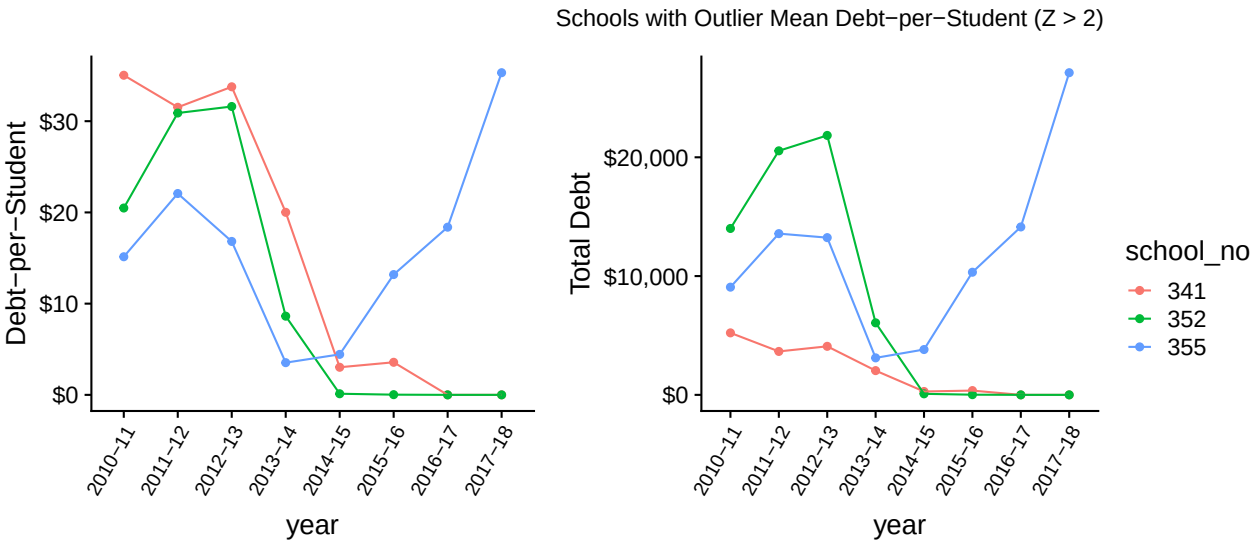


There are definitely some outliers in our data when it comes to variance of within-school debt per student and mean debt-per-student. Let's pull any schools that fall greater than 2 standard deviations from the mean (proper outliers) and see what their debt-per-student looks like longitudinally.

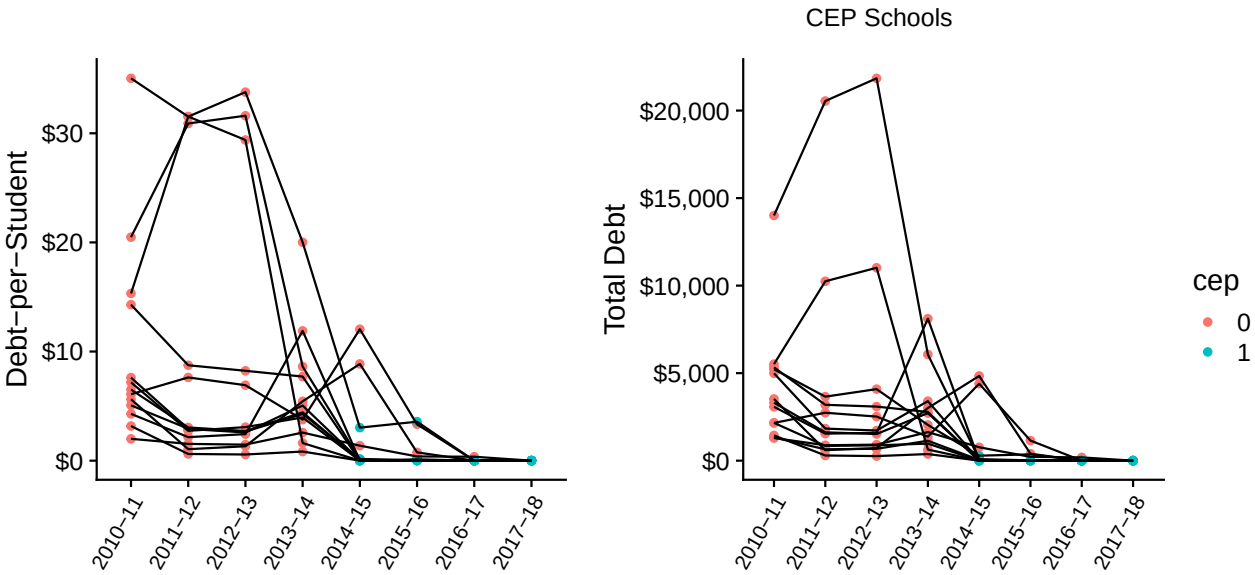
High variance schools



Schools with the most debt



CEP Schools



NOTES:

KC [dot] Elander @ dpi.nc.gov

- CEP provisions began in 2014-15 in NC
- data collected at different times so numbers won't match perfectly

FOR NEXT WEEK: - get 2010-11, 2011-12, 2012-13, 2013-14 and 2017-18 CEP data - fill missing adm/pct needy data (why missing?) - ask about when school lunch data pulled

- external factors (paying off debt, CEP status)
- how to track people paying off debt/dates?
- think about fairly comparing schools
- LONG TERM: can a student graduate with debt? are they barred from anything? what are consequences besides food?