ECON 398 Emperical Project

Results and Discussions

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**1) Results:**

Table 1 shows the two-way district and year fixed effects regression results with the same outcome of interest as the growth index for student performance at the Math MCAS but using five different modifications. The independent variable of interest is the percentage of teachers retained from the previous year and is included in all five models. Model 2 and 3 add compositional controls and environmental controls, respectively, while Model 4 and 5 have similar specifications to the former two but also including a ‘poor’ district dummy and its interaction term with the teacher retention variable.

According to Model 1, with the district and time fixed effects, a 1% increase in teacher retention rate means a .172 decrease in the student performance growth index with 10% significance. When controlling for the compositional variables, the effect is enlarged to a .181 decrease and improve in significance to satisfy the 5% level. Model 3 further controls for disruptive factors and sees a minor increase in magnitude to a .183 drop in the growth index for each 1% of teachers retained. Thus, we can infer that for the districts observed, high retention likely points to lower gains in student performance, and that compositional factors of student cohort and teacher quality might produce an upward bias on the coefficient of interest while environmental factors bring an upward bias to a lesser degree. However, as all of these factors aside from current student performance are not correlated with the dependent variable, it is inconclusive whether any of them cause omitted variable bias, including the current performance variable due to insignificant results in correlation test with retention. While the trend of bias from the compositional and environmental factors on the relationship of interest is consistent if not robust, the majority of literature suggests that high turnover affects student achievements negatively (Sorensen and Ladd 2020; Ronfeld 2013), but some have made the case for turnover being useful in providing better fit and necessary attrition (Temin 2002; Hanushek and Rivkin 2010).

Model 4 and 5 compares the effects of retention on performance in schools of different poverty levels. While the coefficients on the ‘poor’ district dummy and the interaction term are not statistically significant, the relationship of interest showed a downward bias (-.181 in Model (2) to -.176 in (4), -.183 in (3) to -.169 in (5)) produced by these factors. Unlike in Model 2 and 3, there is a downward change in the effect of retention when adding disruptive controls, from a decrease of .176 to a decrease of .169 and losing significance, which is partly due to the decrease in the interaction term coefficient from 0.0023 to -0.0112. Additionally, as this coefficient is not statistically significant, it is difficult to estimate a reliable result. While these findings cannot reaffirm the literature, which considers poorer schools as particularly benefiting from lower retention (Ronfeld 2013), the shift from a significant, negative relationship between retention and performance to a more ambiguous one points to a similar direction.

**Table 1:** Regression results:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Dependent variable: Student growth in performance index | | | | | | | | | |
| Independent variables | (1) | | (2) | | (3) | | (4) | | (5) | |
| **Teacher retention** | -0.172\* | | -0.181\*\* | | -0.183\*\* | | -0.176\* | | -0.169 | |
|  | (0.0917) | | (0.0860) | | (0.0871) | | (0.103) | | (0.104) | |
| **Environment controls:** |  | |  | |  | |  | |  | |
| Principal retention |  | |  | | 0.00429 | |  | | 0.00419 | |
|  |  | |  | | (0.00923) | |  | | (0.00884) | |
| Serious offence rates |  | |  | | -0.0882 | |  | | -0.0528 | |
|  |  | |  | | (0.404) | |  | | (0.366) | |
| **Compositional control:** |  | |  | |  | |  | |  | |
| Quality instructor rates |  | | -0.0638 | | -0.0642 | | -0.0897 | | -0.0945 | |
|  |  | | (0.0543) | | (0.0581) | | (0.0658) | | (0.0682) | |
|  |  | |  | |  | |  | |  | |
| Current performance |  | | 1.807\*\*\* | | 1.810\*\*\* | | 1.795\*\*\* | | 1.800\*\*\* | |
|  |  | | (0.258) | | (0.260) | | (0.241) | | (0.243) | |
| Student poverty rates |  | | 0.0824 | | 0.0882 | | 0.0827 | | 0.0922 | |
|  |  | | (0.0545) | | (0.0560) | | (0.0557) | | (0.0571) | |
| Female student rates |  | | -0.326 | | -0.322 | | -0.330 | | -0.326 | |
|  |  | | (0.213) | | (0.215) | | (0.217) | | (0.220) | |
|  |  | |  | |  | |  | |  | |
| ‘Poor’ dummy |  | |  | |  | | 2.696 | | 3.891 | |
|  |  | |  | |  | | (16.27) | | (16.13) | |
| Retention and poor interaction term |  | |  | |  | | 0.00230 | | -0.0112 | |
|  |  | |  | |  | | (0.184) | | (0.181) | |
| Constant | 67.13\*\*\* | | -65.58\*\*\* | | -66.00\*\*\* | | -63.78\*\*\* | | -64.81\*\*\* | |
|  | (8.218) | | (23.84) | | (24.99) | | (21.15) | | (22.45) | |
| District fixed effects | Y | | Y | | Y | | Y | | Y | |
| Year fixed effects | Y | | Y | | Y | | Y | | Y | |
| Observations | 360 | | 360 | | 360 | | 360 | | 360 | |
| R-squared | 0.066 | | 0.347 | | 0.347 | | 0.362 | | 0.362 | |
| Number of district codes | 90 | | 90 | | 90 | | 90 | | 90 | |
| Robust standard errors in parentheses | |  | |  | |  | |  | |
| \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 | |  | |  | |  | |  | |

**2. Discussion:**

The regression results in the first three models show that for the 90 school districts in Massachusetts observed over a four-year period, having higher teacher retention rates mean that student performance growth from the previous year would decrease. These results are not consistent with the majority of the literature, which suggests that higher turnover harms student achievement due to compositional factors regarding teaching quality and the disruptive effects of faculty change. However, there are theoretical advantages to turnover, such as allowing for better teacher-school fit and maintain greater competition and thus higher performance, with Hanushek and Rivkin (2010) providing evidence that teachers who stay are often more qualified than those leaving, even in low-income schools. In fact, the Massachusetts K-12 system is considered one of the best in the country, with ample funding, stringent accountability measures and relatively healthy supply of qualified teachers, thus minimizing the risks of decline in quality from turnover, both compositionally and environmentally (Wong 2016). However, there are still issues of achievement gap and segregation that negatively affect poorer schools. The paper examines the effects of retention on performance dependent on whether a school is low-income as well and observes that the relationship of interest declines in both magnitude and significance. This means that allowing high turnover might not be beneficial to student performance, and more effort should be made to retain high-performing teachers.

The paper also contains some limitations that hinder a deeper analysis. Firstly, the individual observations are at the school district level and for all grades, which does not allow for examining the dynamics of a group of teachers at a single school. Secondly, these results are from school districts that chose to report these data, which means that they can be lacking if generalized to apply to the entire state. There are also only four years of data, which restricts from analyzing more long-term effects. Thus, to expand our knowledge of the relationship between turnover and achievement for students, more detailed observations at preferable the individual teacher/student or school level coupled with more years of data would be useful in controlling for and understanding variations. Meanwhile, more variables measuring teacher ability and satisfaction would provide more policy recommendations for increasing the public gains education brings.

Bibliography

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