

# Estimating a game of managing school district capacity as parents vote with their feet: Online appendix

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## APPENDIX A: FIRST STAGE IV REGRESSIONS

Table A.1 reports the first stage of the instrumental variables (IV) estimator that uses the peer measures that are predicted by the feeder zone as instruments, that is, the peer measures that would result in equilibrium if all students attended the schools that they are assigned to initially by the district. Similarly, Table A.2 shows that first first stage of the IV estimator that uses lagged values of the peer measures as instruments. All regressions also control for elementary and middle school dummy variables.<sup>1</sup>

Overall, three patterns arise from these regressions. First, we find that each set of instruments has strong predictive power. The  $R^2$  values range between 0.891 and 0.936 for the feeder patterns and between 0.839 and 0.973 for the lagged instruments. The main concern would be that the instruments may be, if anything, too strong. Second, the results in Table A.2 show that there is some evidence of mean reversion in the peer characteristics. The estimated lagged coefficients range between 0.682 and 0.938. The racial and income composition of schools shows the strongest persistent over time, while average offenses and suspensions are least persistent. Third, we find the largest changes in the peer characteristics of schools in the 2 years spanning the school closing in 2005/06.

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<sup>1</sup>These tables are reported in the Appendix of the paper and are also replicated at the end of this document.

TABLE A.1. IV First stage: feeder patterns.

| Variables            | (1)                   | (2)                  | (3)                     | (4)                 |
|----------------------|-----------------------|----------------------|-------------------------|---------------------|
|                      | FRL                   | Race                 | Achievement             | Suspensions         |
| Feeder FRL           | 1.001***<br>(0.0389)  | -0.152*<br>(0.0816)  | 0.0292**<br>(0.0117)    | -0.724<br>(0.551)   |
| Feeder race          | 0.131***<br>(0.0243)  | 1.111***<br>(0.0415) | -0.0406***<br>(0.00499) | 0.284<br>(0.297)    |
| Feeder achievement   | 0.378***<br>(0.103)   | 0.0825<br>(0.223)    | 0.811***<br>(0.0280)    | -1.716<br>(1.151)   |
| Feeder suspensions   | 0.00104<br>(0.00371)  | 0.00380<br>(0.00723) | 0.000117<br>(0.00108)   | 1.097***<br>(0.145) |
| 1(Elementary School) | -0.00571<br>(0.00789) | 0.00235<br>(0.0160)  | -0.00524**<br>(0.00232) | -0.158<br>(0.102)   |
| 1(Middle School)     | 0.0287*<br>(0.0148)   | 0.0336<br>(0.0238)   | -0.00678*<br>(0.00384)  | 0.582<br>(0.410)    |
| Constant             | -0.302***<br>(0.0991) | 0.0249<br>(0.218)    | 0.146***<br>(0.0244)    | 1.879<br>(1.218)    |
| Observations         | 196                   | 196                  | 196                     | 196                 |
| $R^2$                | 0.928                 | 0.921                | 0.935                   | 0.889               |

Note: Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

TABLE A.2. IV First stage: lagged variables.

| Variables            | (1)                    | (2)                     | (3)                     | (4)                  |
|----------------------|------------------------|-------------------------|-------------------------|----------------------|
|                      | FRL                    | Race                    | Achievement             | Suspensions          |
| Lagged FRL           | 0.973***<br>(0.0425)   | 0.0743***<br>(0.0271)   | -0.00851<br>(0.00672)   | 1.404***<br>(0.421)  |
| Lagged race          | -0.0237<br>(0.0188)    | 0.924***<br>(0.0190)    | -0.00106<br>(0.00376)   | -0.282<br>(0.342)    |
| Lagged achievement   | -0.0403<br>(0.155)     | -0.0103<br>(0.105)      | 0.883***<br>(0.0399)    | -1.279<br>(1.992)    |
| Lagged suspensions   | -0.000870<br>(0.00183) | -0.000164<br>(0.000208) | -2.30e-05<br>(9.96e-05) | 0.642***<br>(0.0555) |
| 1(Elementary School) | 0.0105<br>(0.00890)    | -0.00686<br>(0.00833)   | -0.00260<br>(0.00199)   | -0.259<br>(0.173)    |
| 1(Middle School)     | 0.0174<br>(0.0114)     | 0.00458<br>(0.00922)    | -0.00445**<br>(0.00193) | 1.227***<br>(0.441)  |
| Constant             | 0.0756<br>(0.152)      | 0.0132<br>(0.0989)      | 0.101***<br>(0.0365)    | 0.556<br>(1.780)     |
| Observations         | 194                    | 194                     | 194                     | 194                  |
| $R^2$                | 0.938                  | 0.973                   | 0.951                   | 0.947                |

Note: Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

APPENDIX B: ADDITIONAL FIGURES AND TABLES

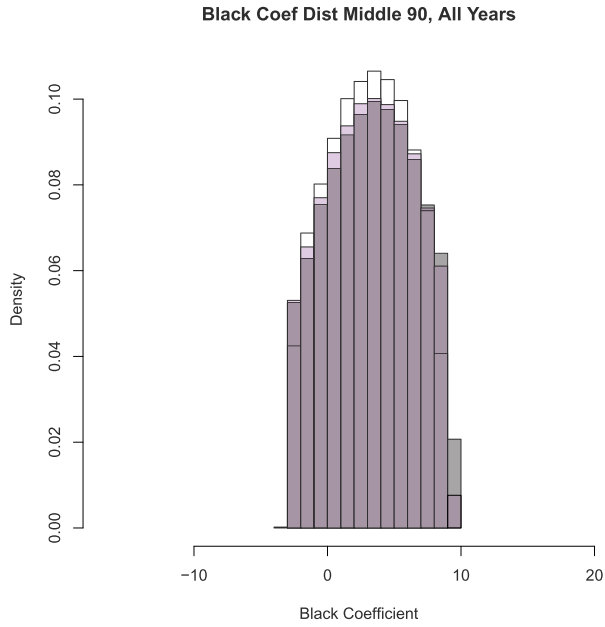


FIGURE B.1. Sensitivity analysis.

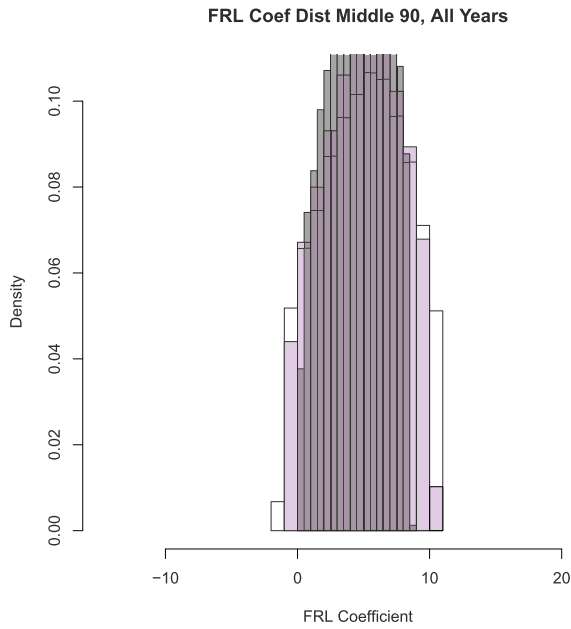


FIGURE B.2. Sensitivity analysis.

TABLE B.3. Optimal school closing analysis: Initial conditions setting school-level proportions of FRL and black equal zero.

|                                     |                             | 1        | 2       | 3         | 4         | 5           |
|-------------------------------------|-----------------------------|----------|---------|-----------|-----------|-------------|
|                                     |                             | Baseline | Quality | Diversity | Retention | Dislocation |
| Pre-sorting School Market Outcomes  |                             |          |         |           |           |             |
| a                                   | Enrollment: Closed Schools  | 0        | 470.7   | 336.6     | 343.6     | 227.1       |
| b                                   | Mean FRL                    | 0.72     | 0.70    | 0.71      | 0.72      | 0.70        |
| c                                   | Mean Black                  | 0.62     | 0.60    | 0.61      | 0.62      | 0.60        |
| d                                   | Mean Achievement            | -0.09    | -0.06   | -0.07     | -0.09     | -0.06       |
| e                                   | Mean Suspensions            | 3.09     | 2.85    | 2.28      | 3.09      | 3.00        |
| f                                   | Std. Dev. FRL               | 0.20     | 0.20    | 0.20      | 0.20      | 0.20        |
| g                                   | Std. Dev. Black             | 0.27     | 0.27    | 0.27      | 0.27      | 0.27        |
| h                                   | Std. Dev. Achievement       | 0.42     | 0.42    | 0.42      | 0.42      | 0.42        |
| i                                   | Std. Dev. Suspensions       | 4.56     | 4.64    | 1.78      | 4.56      | 4.72        |
| Post-sorting School Market Outcomes |                             |          |         |           |           |             |
| j                                   | Enrollment: Outside Options | 1725.4   | 1623.3  | 1353      | 1408      | 1413.7      |
| k                                   | Mean FRL                    | 0.72     | 0.69    | 0.68      | 0.71      | 0.68        |
| l                                   | Mean Black                  | 0.62     | 0.59    | 0.59      | 0.62      | 0.57        |
| m                                   | Mean Achievement            | -0.09    | -0.82   | -0.47     | -0.70     | -0.24       |
| n                                   | Mean Suspensions            | 3.09     | 4.27    | 2.85      | 5.36      | 4.67        |
| o                                   | Std. Dev. FRL               | 0.20     | 0.26    | 0.24      | 0.24      | 0.23        |
| p                                   | Std. Dev. Black             | 0.27     | 0.31    | 0.30      | 0.29      | 0.29        |
| q                                   | Std. Dev. Achievement       | 0.42     | 1.97    | 1.54      | 1.85      | 0.97        |
| r                                   | Std. Dev. Suspensions       | 4.56     | 10.36   | 3.32      | 11.50     | 11.75       |

*Note:* All means and standard deviations are for the remaining open public schools. We use the baseline probabilities for the pre-sorting panel. This table is for students in grades 6-8;  $N = 8,245$ .

TABLE B.4. Optimal school closing analysis: initial conditions setting school-level proportions of FRL and black equal one.

|                                     |                             | 1        | 2       | 3         | 4         | 5           |
|-------------------------------------|-----------------------------|----------|---------|-----------|-----------|-------------|
|                                     |                             | Baseline | Quality | Diversity | Retention | Dislocation |
| Pre-sorting School Market Outcomes  |                             |          |         |           |           |             |
| a                                   | Enrollment: Closed Schools  | 0        | 470.7   | 336.6     | 343.6     | 227.1       |
| b                                   | Mean FRL                    | 0.72     | 0.70    | 0.71      | 0.72      | 0.70        |
| c                                   | Mean Black                  | 0.62     | 0.60    | 0.61      | 0.62      | 0.60        |
| d                                   | Mean Achievement            | -0.09    | -0.06   | -0.07     | -0.09     | -0.06       |
| e                                   | Mean Suspensions            | 3.09     | 2.85    | 2.28      | 3.09      | 3.00        |
| f                                   | Std. Dev. FRL               | 0.20     | 0.20    | 0.20      | 0.20      | 0.20        |
| g                                   | Std. Dev. Black             | 0.27     | 0.27    | 0.27      | 0.27      | 0.27        |
| h                                   | Std. Dev. Achievement       | 0.42     | 0.42    | 0.42      | 0.42      | 0.42        |
| i                                   | Std. Dev. Suspensions       | 4.56     | 4.64    | 1.78      | 4.56      | 4.72        |
| Post-sorting School Market Outcomes |                             |          |         |           |           |             |
| j                                   | Enrollment: Outside Options | 1725.4   | 1623.3  | 1352.7    | 1407.7    | 1413.7      |
| k                                   | Mean FRL                    | 0.72     | 0.69    | 0.68      | 0.71      | 0.68        |
| l                                   | Mean Black                  | 0.62     | 0.59    | 0.59      | 0.62      | 0.57        |
| m                                   | Mean Achievement            | -0.09    | -0.83   | -0.47     | -0.70     | -0.24       |
| n                                   | Mean Suspensions            | 3.09     | 4.27    | 2.85      | 5.36      | 4.68        |
| o                                   | Std. Dev. FRL               | 0.20     | 0.26    | 0.24      | 0.24      | 0.23        |
| p                                   | Std. Dev. Black             | 0.27     | 0.31    | 0.30      | 0.29      | 0.29        |
| q                                   | Std. Dev. Achievement       | 0.42     | 1.97    | 1.54      | 1.85      | 0.97        |
| r                                   | Std. Dev. Suspensions       | 4.56     | 10.35   | 3.32      | 11.50     | 11.76       |

*Note:* All means and standard deviations are for the remaining open public schools. We use the baseline probabilities for the pre-sorting panel. This table is for students in grades 6–8;  $N = 8,245$ .

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