

The Impact of Low-Ability Peers on Cognitive and Non-Cognitive Outcomes:

Random Assignment Evidence on the Effects and Operating Channels

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Appendix (for online publication only)

Online Appendix 1

*Principle Factor Analysis for the Non-Cognitive Outcomes*

Following Gong, Lu, and Song (2018), we conduct a principle factor analysis to group the non-cognitive outcomes. Table 1 in Online Appendix 1 shows the principle factors, eigenvalues, and proportions of variance explained. We choose the first five factors as our principle factors based on their eigenvalues (equal to or larger than 1) and the cumulative explained variance (68.4%).

Online Appendix 1 Table 1

*Principle Factor Analysis*

| Factor   | Eigenvalue | Difference | Proportion | Cumulative |
|----------|------------|------------|------------|------------|
| Factor1  | 3.607      | 1.931      | 0.278      | 0.278      |
| Factor2  | 1.676      | 0.194      | 0.129      | 0.406      |
| Factor3  | 1.482      | 0.334      | 0.114      | 0.520      |
| Factor4  | 1.147      | 0.162      | 0.088      | 0.609      |
| Factor5  | 0.985      | 0.242      | 0.076      | 0.684      |
| Factor6  | 0.743      | 0.169      | 0.057      | 0.742      |
| Factor7  | 0.574      | 0.030      | 0.044      | 0.786      |
| Factor8  | 0.544      | 0.033      | 0.042      | 0.828      |
| Factor9  | 0.511      | 0.019      | 0.039      | 0.867      |
| Factor10 | 0.492      | 0.063      | 0.038      | 0.905      |
| Factor11 | 0.429      | 0.011      | 0.033      | 0.938      |
| Factor12 | 0.418      | 0.024      | 0.032      | 0.970      |
| Factor13 | 0.394      | .          | 0.030      | 1          |

Table 2 in Online Appendix 1 presents the factor loadings after rotation. After examining the correlation between the factors and the original variables, we are able to group variables to different categories. We specifically focus on loadings larger than 0.6. The correlation suggests that variables “feeling down,” “depressed,” “unhappy,” “not enjoying life,” and “sad” can be grouped as the first factor, which indicate the level of mental stress. Variables “I am often late for school” and “I am often absent from school” can be grouped as the second factor. Similarly, variables “I seldom participate in school or

class activities” and “I do not feel close to people at this school” can be grouped as the third factor, and “I feel bored at school” and “I want to attend another school” can be grouped as the fourth. Lastly, variables “confidence about future” and “expected years of education” are grouped as the fifth factor. Together, the five factors explain most of the variation (68.4%) in the data. We further present the component loadings visually in Online Appendix 1 Figure 1 and find similar patterns.

The KMO test also supports the validity of our principle factor analysis (Online Appendix 1 Table 3). The overall KMO estimate is 0.8, which suggests that the sampling is meritorious (Kaiser 1974).

To summarize, we are able to group the thirteen non-cognitive outcomes into five categories using principle factor analysis. The first category measures the level of mental stress and includes feeling down, depressed, unhappy, not enjoying life, and sad. The second category measures school attendance and includes being late and absent from school. The third category measures school participation and includes level of participation in school activities and feeling not close with people in school. The fourth category measures the overall satisfaction with school experience and includes feeling bored and wanting to attend another school. The last category measures educational expectations and includes confidence about future and expected years of education. In our analysis, we combine the second to the fourth categories into one group given they are closely related and naturally fall into one category measuring overall school disengagement.

Online Appendix 1 Table 2

*Contribution of Variables to Principle Factors*

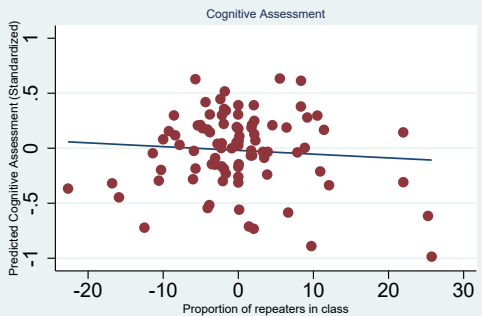
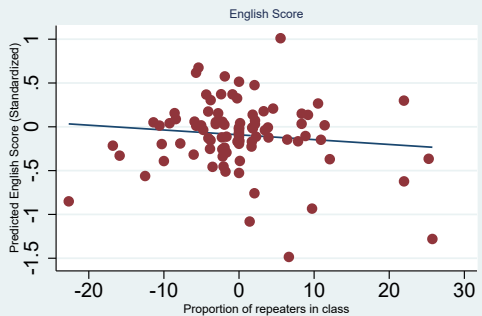
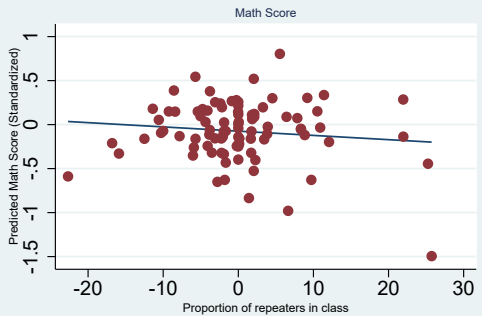
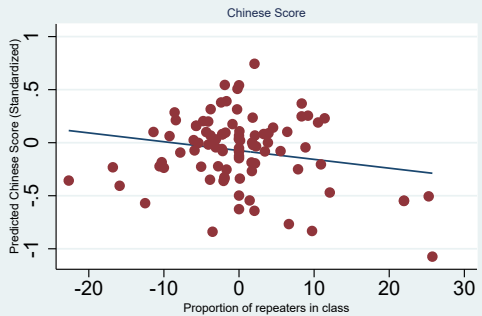
| Variable   | Factor1 | Factor2 | Factor3 | Factor4 | Factor5 | Uniqueness |
|--|---------|---------|---------|---------|---------|------------|
| Feeling down                                       | 0.805   | 0.028   | 0.003   | 0.047   | 0.007   | 0.349      |
| Depressed  | 0.790   | 0.037   | 0.115   | 0.082   | -0.002  | 0.354      |
| Unhappy  | 0.792   | 0.019   | 0.112   | 0.087   | -0.057  | 0.349      |
| Not enjoying life                                  | 0.680   | 0.020   | 0.269   | 0.083   | -0.097  | 0.448      |
| Sad  | 0.783   | 0.041   | 0.048   | 0.035   | -0.075  | 0.376      |
| I am often late for school                         | 0.046   | 0.884   | 0.050   | 0.056   | 0.001   | 0.211      |
| I am often absent from school                      | 0.022   | 0.881   | 0.084   | -0.028  | -0.045  | 0.213      |
| I seldom participate in school or class activities | 0.056   | 0.029   | -0.036  | 0.857   | -0.117  | 0.247      |
| I do not feel close to people at this school       | 0.109   | 0.002   | 0.206   | 0.819   | -0.026  | 0.275      |
| I feel bored at school                             | 0.148   | 0.077   | 0.808   | 0.139   | -0.091  | 0.292      |
| I want to attend another school                    | 0.089   | 0.081   | 0.852   | 0.021   | -0.001  | 0.260      |
| Confidence about future                            | -0.231  | -0.007  | -0.126  | -0.210  | 0.629   | 0.491      |
| Expected years of education                        | 0.009   | -0.038  | -0.022  | -0.050  | 0.869   | 0.240      |

Online Appendix 1 Table 3

*Kaiser-Meyer-Olkin Measure for Sampling Adequacy*

| Variable   | KMO   |
|--|-------|
| Feeling down                                       | 0.850 |
| Depressed  | 0.869 |
| Unhappy  | 0.874 |
| Not enjoying life                                  | 0.892 |
| Sad  | 0.877 |
| I am often late for school                         | 0.549 |
| I am often absent from school                      | 0.539 |
| I seldom participate in school or class activities | 0.646 |
| I do not feel close to people at this school       | 0.707 |
| I feel bored at school                             | 0.753 |
| I want to attend another school                    | 0.720 |
| Confidence about future                            | 0.863 |
| Expected years of education                        | 0.723 |
| Overall  | 0.794 |

The Relationship between First Differences in Average Predicted Outcomes of Non-repeaters and First Differences in the Proportion of Repeaters



Online Appendix 1 Figure 1

Online Appendix Table 2

*Impacts of Repeaters on Non-repeaters' Cognitive and Noncognitive Outcomes: Results by Survey Items*

|  | (1)                  | (2)                  | (3)                  | (4)                  | (5)  |
|--|----------------------|----------------------|----------------------|----------------------|------|
| <i>Panel A: Academic performance</i>               |                      |                      |                      |                      |      |
| Chinese midterm                                    | -0.027**<br>(0.009)  | -0.024**<br>(0.008)  | -0.024**<br>(0.008)  | -0.021**<br>(0.007)  | 6939 |
| Math midterm                                       | -0.026**<br>(0.010)  | -0.023**<br>(0.008)  | -0.018*<br>(0.007)   | -0.015*<br>(0.007)   | 6939 |
| English midterm                                    | -0.035***<br>(0.008) | -0.031***<br>(0.007) | -0.030***<br>(0.007) | -0.027***<br>(0.006) | 6939 |
| <i>Panel B: Cognitive assessment</i>               |                      |                      |                      |                      |      |
| Cognitive assessment                               | -0.025**<br>(0.008)  | -0.023**<br>(0.008)  | -0.026***<br>(0.007) | -0.023***<br>(0.006) | 7062 |
| <i>Panel C: Mental stress</i>                      |                      |                      |                      |                      |      |
| Feeling down                                       | 0.008+<br>(0.005)    | 0.008+<br>(0.004)    | 0.006<br>(0.005)     | 0.005<br>(0.005)     | 6904 |
| Depressed  | 0.002<br>(0.004)     | 0.001<br>(0.004)     | 0.000<br>(0.004)     | -0.001<br>(0.004)    | 6904 |
| Unhappy  | 0.003<br>(0.004)     | 0.002<br>(0.004)     | 0.001<br>(0.004)     | -0.000<br>(0.003)    | 6904 |
| Not enjoying life                                  | 0.011*<br>(0.005)    | 0.010*<br>(0.004)    | 0.007+<br>(0.004)    | 0.006+<br>(0.003)    | 6904 |
| Sad  | 0.008<br>(0.005)     | 0.007<br>(0.005)     | 0.003<br>(0.005)     | 0.004<br>(0.005)     | 6904 |
| <i>Panel D: School disengagement</i>               |                      |                      |                      |                      |      |
| I am often late for school                         | 0.005<br>(0.004)     | 0.004<br>(0.004)     | 0.004<br>(0.003)     | 0.004<br>(0.003)     | 6969 |
| I am often absent from school                      | 0.002<br>(0.005)     | 0.002<br>(0.005)     | 0.001<br>(0.003)     | 0.000<br>(0.003)     | 5825 |
| I seldom participate in school or class activities | 0.011**<br>(0.004)   | 0.009*<br>(0.004)    | 0.006+<br>(0.003)    | 0.007+<br>(0.004)    | 7029 |
| I do not feel close to people at this school       | 0.016***<br>(0.004)  | 0.015***<br>(0.004)  | 0.011**<br>(0.004)   | 0.011**<br>(0.004)   | 7029 |
| I feel bored at school                             | 0.014*<br>(0.006)    | 0.014*<br>(0.005)    | 0.011*<br>(0.005)    | 0.012*<br>(0.005)    | 7029 |
| I want to attend another school                    | 0.012+<br>(0.006)    | 0.012+<br>(0.006)    | 0.007<br>(0.006)     | 0.008<br>(0.006)     | 7013 |
| <i>Panel E: Educational expectation</i>            |                      |                      |                      |                      |      |
| Expected years of education                        | -0.014*<br>(0.006)   | -0.011+<br>(0.006)   | -0.006<br>(0.005)    | -0.003<br>(0.004)    | 7020 |
| Confidence about future                            | -0.012**<br>(0.004)  | -0.010**<br>(0.004)  | -0.004<br>(0.004)    | -0.004<br>(0.004)    | 7020 |
| School fixed effects                               | Yes                  | Yes                  | Yes                  | Yes                  | —    |
| Individual controls                                | No                   | Yes                  | Yes                  | Yes                  | —    |
| Homeroom teacher controls                          | No                   | No                   | Yes                  | Yes                  | —    |
| Classroom average peer controls                    | No                   | No                   | No                   | Yes                  | —    |

*Note:* All outcome variables are standardized within non-repeaters within each school. Individual controls, homeroom teacher controls, and classroom average peer controls are added progressively in each specification. Individual, homeroom teacher, and classroom average peer controls are the same with previous analyses. School FE models. Standard errors in parentheses. <sup>+</sup>  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Online Appendix Table 3

*Descriptive Statistics of Homeroom Teacher and Classroom Characteristics*

|                                    | Mean<br>(SD)       |
|------------------------------------|--------------------|
| Homeroom teacher female            | 0.689<br>(0.464)   |
| Homeroom teacher age in years      | 36.150<br>(7.196)  |
| <i>Education level</i>             |                    |
| Professional college education     | 0.093<br>(0.291)   |
| Adult higher education             | 0.366<br>(0.483)   |
| College education or higher        | 0.541<br>(0.500)   |
| Graduated from a normal university | 0.907<br>(0.291)   |
| Have a teaching certificate        | 0.995<br>(0.074)   |
| Teaching experience in years       | 14.210<br>(9.010)  |
| <i>Teaching title</i>              |                    |
| No title                           | 0.115<br>(0.320)   |
| Level 2 or 3                       | 0.361<br>(0.482)   |
| Level 1                            | 0.377<br>(0.486)   |
| Senior teacher or higher           | 0.148<br>(0.356)   |
| <i>Teaching award</i>              |                    |
| School level or no award           | 0.262<br>(0.441)   |
| County or district level           | 0.366<br>(0.483)   |
| City level                         | 0.257<br>(0.438)   |
| Provincial or national level       | 0.115<br>(0.320)   |
| Class size                         | 46.360<br>(12.780) |
| Observations                       | 183                |

*Notes:* Data are collapsed to class level. A normal university is a type of 4-year university in China that specializes in teacher workforce training. Standard deviations in parentheses.

Online Appendix Table 4

*Differences between Classrooms in Schools that Used Random Assignment and Those that Did Not*

|  | Random<br>assignment<br>(1) | Non-random<br>assignment<br>(2) | Raw gap<br>(3)       |
|--|-----------------------------|---------------------------------|----------------------|
| <i>Panel A: School-level characteristics</i>         |                             |                                 |                      |
| Located in rural regions                             | 0.344<br>(0.478)            | 0.562<br>(0.512)                | -0.218+<br>(0.131)   |
| School size  | 990.600<br>(693.600)        | 910.400<br>(553.800)            | 80.238<br>(194.704)  |
| Average class size                                   | 45.640<br>(12.430)          | 45.880<br>(13.070)              | -0.240<br>(3.597)    |
| School funding in the current year per student (RMB) | 1074.200<br>(835.100)       | 872.000<br>(410.700)            | 202.167<br>(220.568) |
| <i>Panel B: Student composition at school</i>        |                             |                                 |                      |
| Proportion of female students in school              | 0.468<br>(0.076)            | 0.454<br>(0.036)                | 0.013<br>(0.019)     |
| Proportion of urban hukou students in school         | 0.473<br>(0.263)            | 0.392<br>(0.277)                | 0.081<br>(0.072)     |
| Proportion of only-child students in school          | 0.432<br>(0.271)            | 0.439<br>(0.257)                | -0.007<br>(0.073)    |
| Student average age in school                        | 13.580<br>(0.335)           | 13.570<br>(0.272)               | 0.005<br>(0.088)     |
| Average mother education in years in school          | 9.659<br>(2.157)            | 9.598<br>(1.682)                | 0.062<br>(0.567)     |
| Average father education in years in school          | 10.390<br>(1.824)           | 10.180<br>(1.662)               | 0.205<br>(0.488)     |
| Proportion of low-income students in school          | 0.196<br>(0.164)            | 0.264<br>(0.186)                | -0.068<br>(0.045)    |

Online Appendix Table 4

*Differences between Classrooms in Schools that Used Random Assignment and Those that Did Not (Continued)*

|   | Random<br>assignment<br>(1) | Non-random<br>assignment<br>(2) | Raw gap<br>(3)     |
|---|-----------------------------|---------------------------------|--------------------|
| <i>Proportion of each mother occupation in school</i> |                             |                                 |                    |
| Civil servants and government officials               | 0.030<br>(0.041)            | 0.027<br>(0.032)                | 0.003<br>(0.011)   |
| Executive and managerial                              | 0.054<br>(0.062)            | 0.034<br>(0.043)                | 0.020<br>(0.016)   |
| Teachers, engineers, doctors, and lawyers             | 0.058<br>(0.055)            | 0.047<br>(0.041)                | 0.011<br>(0.014)   |
| Technicians (including drivers)                       | 0.043<br>(0.038)            | 0.045<br>(0.030)                | -0.002<br>(0.010)  |
| Manufacturing workers                                 | 0.117<br>(0.109)            | 0.103<br>(0.075)                | 0.014<br>(0.028)   |
| Marketing, sales, and service                         | 0.151<br>(0.080)            | 0.142<br>(0.106)                | 0.010<br>(0.023)   |
| Self-employed   | 0.156<br>(0.099)            | 0.109<br>(0.102)                | 0.047+<br>(0.027)  |
| Farmers   | 0.200<br>(0.248)            | 0.355<br>(0.308)                | -0.155*<br>(0.070) |
| Unemployed  | 0.089<br>(0.056)            | 0.075<br>(0.061)                | 0.013<br>(0.015)   |
| Other   | 0.073<br>(0.059)            | 0.041<br>(0.027)                | 0.032*<br>(0.015)  |
| <i>Proportion of each father occupation in school</i> |                             |                                 |                    |
| Civil servants and government officials               | 0.046<br>(0.054)            | 0.036<br>(0.037)                | 0.010<br>(0.014)   |
| Executive and managerial                              | 0.087<br>(0.098)            | 0.0493<br>(0.066)               | 0.038<br>(0.026)   |
| Teachers, engineers, doctors, and lawyers             | 0.068<br>(0.050)            | 0.056<br>(0.033)                | 0.012<br>(0.013)   |
| Technicians (including drivers)                       | 0.173<br>(0.082)            | 0.198<br>(0.078)                | -0.025<br>(0.022)  |
| Manufacturing workers                                 | 0.094<br>(0.082)            | 0.084<br>(0.062)                | 0.010<br>(0.021)   |
| Marketing, sales, and service                         | 0.082<br>(0.046)            | 0.082<br>(0.058)                | 0.000<br>(0.013)   |
| Self-employed   | 0.161<br>(0.109)            | 0.100<br>(0.098)                | 0.061*<br>(0.029)  |
| Farmers   | 0.174<br>(0.222)            | 0.305<br>(0.283)                | -0.131*<br>(0.063) |
| Unemployed  | 0.025<br>(0.025)            | 0.024<br>(0.015)                | 0.002<br>(0.007)   |
| Other   | 0.061<br>(0.045)            | 0.047<br>(0.040)                | 0.014<br>(0.012)   |

Online Appendix Table 4

*Differences between Classrooms in Schools that Used Random Assignment and Those that Did Not*  
(Continued)

|  | Random<br>assignment<br>(1) | Non-random<br>assignment<br>(2) | Raw<br>gap<br>(3)  |
|--|-----------------------------|---------------------------------|--------------------|
| <i>Proportion of each family risk factor in school</i> |                             |                                 |                    |
| At least one parent is absent from home                | 0.234<br>(0.170)            | 0.209<br>(0.139)                | 0.026<br>(0.045)   |
| Father gets drunk regularly                            | 0.079<br>(0.052)            | 0.089<br>(0.042)                | -0.010<br>(0.014)  |
| Parents always quarrel                                 | 0.091<br>(0.045)            | 0.099<br>(0.025)                | -0.007<br>(0.012)  |
| <i>Panel C: Teacher composition at school</i>          |                             |                                 |                    |
| Proportion of female homeroom teachers in school       | 0.688<br>(0.345)            | 0.625<br>(0.342)                | 0.063<br>(0.093)   |
| Homeroom teacher average age in years                  | 36.130<br>(5.769)           | 38.970<br>(4.808)               | -2.834+<br>(1.528) |
| <i>Proportion of each educational level in school</i>  |                             |                                 |                    |
| Professional college education                         | 0.097<br>(0.236)            | 0.125<br>(0.224)                | -0.028<br>(0.063)  |
| Adult higher education                                 | 0.366<br>(0.362)            | 0.469<br>(0.386)                | -0.103<br>(0.099)  |
| College education or higher                            | 0.538<br>(0.392)            | 0.406<br>(0.417)                | 0.131<br>(0.107)   |
| Proportion graduated from a normal university          | 0.903<br>(0.212)            | 0.875<br>(0.224)                | 0.028<br>(0.058)   |
| Proportion having a teaching certificate               | 0.995<br>(0.052)            | 1.000<br>(0.000)                | -0.005<br>(0.013)  |
| Average teaching experience in years                   | 14.250<br>(6.862)           | 17.030<br>(5.617)               | -0.005<br>(0.013)  |
| <i>Proportion of each teaching title in school</i>     |                             |                                 |                    |
| No title   | 0.118<br>(0.289)            | 0.000<br>(0.000)                | 0.118<br>(0.073)   |
| Level 2 or 3   | 0.360<br>(0.371)            | 0.406<br>(0.375)                | -0.046<br>(0.101)  |
| Level 1  | 0.376<br>(0.381)            | 0.469<br>(0.386)                | -0.092<br>(0.103)  |
| Senior teacher or higher                               | 0.145<br>(0.282)            | 0.125<br>(0.289)                | 0.020<br>(0.076)   |

Online Appendix Table 4

*Differences between Classrooms in Schools that Used Random Assignment and Those that Did Not  
(Continued)*

|   | Random<br>assignment<br>(1) | Non-random<br>assignment<br>(2) | Raw<br>gap<br>(3) |
|---|-----------------------------|---------------------------------|-------------------|
| <i>Proportion of each teaching award in school</i>                            |                             |                                 |                   |
| School level or no award  | 0.263<br>(0.318)            | 0.281<br>(0.315)                | -0.018<br>(0.086) |
| County or district level  | 0.366<br>(0.339)            | 0.344<br>(0.352)                | 0.022<br>(0.092)  |
| City level  | 0.258<br>(0.300)            | 0.156<br>(0.239)                | 0.102<br>(0.079)  |
| Provincial or national level  | 0.113<br>(0.246)            | 0.188<br>(0.310)                | -0.075<br>(0.069) |
| Class size  | 46.310<br>(13.050)          | 47.120<br>(7.588)               | -0.819<br>(3.363) |
| <i>Panel D: Student average cognitive and noncognitive outcomes in school</i> |                             |                                 |                   |
| Academic performance  | 77.350<br>(14.680)          | 80.200<br>(14.500)              | -2.845<br>(3.967) |
| Cognitive assessment  | 10.680<br>(1.859)           | 10.550<br>(1.480)               | 0.131<br>(0.490)  |
| Mental stress   | 2.002<br>(0.197)            | 2.015<br>(0.126)                | -0.013<br>(0.051) |
| School disengagement  | 1.858<br>(0.0744)           | 1.834<br>(0.0607)               | 0.025<br>(0.020)  |
| Expected years of education   | 16.080<br>(1.190)           | 15.980<br>(1.257)               | 0.093<br>(0.325)  |
| Confidence about future   | 3.284<br>(0.189)            | 3.279<br>(0.168)                | 0.005<br>(0.050)  |
| Observations  | 93                          | 16                              | 109               |

*Notes:* Data collapsed to school level. Three schools have a missing value on the random assignment status variable and are excluded. Columns (1) and (2) present the means of each variable with standard deviations in parentheses. In column (3), we regress each variable on the random assignment dummy to examine the raw gap between the schools that used random assignment and the schools that did not. The variables in Panel A are from the school administrator's questionnaire. The variables in Panels B, C, and D are calculated by taking the average score of the two classrooms per school in our sample.

+  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Online Appendix Table 5

*Missing Patterns of Selected Outcome Variables*

|  | Missing English<br>midterm | Missing “not<br>enjoying life” | Missing “I am<br>always absent<br>from school” | Missing “I am<br>not close with<br>people in my<br>school” | Missing<br>expected years<br>of education | Missing “My<br>homeroom<br>teacher always<br>praises me” | Missing<br>“My class is<br>in good<br>atmosphere” | Missing “Having<br>friends with<br>general<br>disciplinary<br>problems” |
|--|----------------------------|--------------------------------|--|--|---|--|---|---|
|  | (1)                        | (2)                            | (3)  | (4)  | (5)                                       | (6)  | (7)   | (8)   |
| Proportion of repeaters                      | -0.000<br>(0.001)          | -0.000<br>(0.001)              | 0.000<br>(0.000)                               | 0.000<br>(0.000)   | -0.001<br>(0.001)                         | -0.000<br>(0.000)  | 0.000<br>(0.000)                                  | -0.000<br>(0.001)   |
| Female                                       | -0.001<br>(0.003)          | -0.007+<br>(0.004)             | 0.001<br>(0.001)                               | 0.001<br>(0.001)   | -0.014**<br>(0.005)                       | 0.002<br>(0.001)   | 0.003<br>(0.002)                                  | -0.006+<br>(0.003)  |
| Urban hukou                                  | -0.004<br>(0.005)          | -0.001<br>(0.004)              | 0.002<br>(0.002)                               | 0.002<br>(0.002)   | -0.000<br>(0.006)                         | 0.001<br>(0.001)   | 0.000<br>(0.002)                                  | -0.002<br>(0.004)   |
| Only child                                   | -0.010*<br>(0.005)         | 0.000<br>(0.005)               | -0.001<br>(0.002)                              | -0.001<br>(0.002)  | -0.006<br>(0.006)                         | -0.001<br>(0.001)  | 0.000<br>(0.002)                                  | -0.001<br>(0.003)   |
| Student age in years                         | 0.003<br>(0.002)           | 0.004<br>(0.004)               | 0.003<br>(0.002)                               | 0.004+<br>(0.002)  | 0.004<br>(0.005)                          | 0.004<br>(0.002)   | 0.006*<br>(0.003)                                 | 0.003<br>(0.003)  |
| Mother education in years                    | -0.000<br>(0.001)          | -0.001<br>(0.001)              | -0.001<br>(0.000)                              | -0.001<br>(0.000)  | 0.000<br>(0.001)                          | -0.001<br>(0.000)  | -0.001+<br>(0.001)                                | -0.001<br>(0.001)   |
| Father education in years                    | -0.000<br>(0.001)          | 0.000<br>(0.001)               | 0.001<br>(0.000)                               | 0.000<br>(0.001)   | -0.002<br>(0.001)                         | 0.000<br>(0.000)   | 0.000<br>(0.000)                                  | 0.000<br>(0.001)  |
| Low income                                   | -0.004<br>(0.005)          | 0.005<br>(0.007)               | -0.005*<br>(0.002)                             | -0.005*<br>(0.002)   | -0.005<br>(0.007)                         | -0.005+<br>(0.002)                                       | -0.006*<br>(0.002)                                | -0.009*<br>(0.004)  |
| <i>Mother occupation</i>                     |                            |                                |  |  |   |  |   |   |
| Executive and managerial                     | 0.008<br>(0.007)           | 0.007<br>(0.009)               | 0.000<br>(0.004)                               | -0.001<br>(0.007)  | -0.018<br>(0.017)                         | 0.003<br>(0.002)   | -0.001<br>(0.007)                                 | 0.001<br>(0.010)  |
| Teachers, engineers, doctors, and<br>lawyers | 0.009<br>(0.008)           | -0.007<br>(0.012)              | 0.003<br>(0.005)                               | 0.000<br>(0.006)   | -0.021<br>(0.017)                         | 0.004+<br>(0.002)  | 0.002<br>(0.007)                                  | 0.011<br>(0.011)  |
| Technicians (including drivers)              | 0.005<br>(0.008)           | 0.004<br>(0.012)               | -0.002<br>(0.004)                              | -0.005<br>(0.007)  | -0.038*<br>(0.015)                        | 0.002<br>(0.002)   | -0.005<br>(0.007)                                 | 0.003<br>(0.011)  |
| Manufacturing workers                        | 0.009<br>(0.008)           | 0.008<br>(0.011)               | 0.000<br>(0.004)                               | -0.004<br>(0.006)  | -0.014<br>(0.016)                         | 0.003<br>(0.003)   | -0.003<br>(0.007)                                 | 0.004<br>(0.011)  |
| Marketing, sales, and service                | 0.001<br>(0.006)           | 0.000<br>(0.009)               | -0.000<br>(0.004)                              | -0.003<br>(0.006)  | -0.028+<br>(0.015)                        | 0.003<br>(0.002)   | -0.003<br>(0.006)                                 | 0.006<br>(0.010)  |
| Self-employed                                | 0.011+<br>(0.006)          | 0.003<br>(0.010)               | -0.000<br>(0.004)                              | -0.004<br>(0.006)  | -0.019<br>(0.015)                         | -0.000<br>(0.002)  | 0.000<br>(0.007)                                  | 0.003<br>(0.011)  |
| Farmers                                      | 0.015<br>(0.009)           | -0.017<br>(0.014)              | -0.007<br>(0.006)                              | -0.011<br>(0.008)  | -0.021<br>(0.015)                         | -0.003<br>(0.004)  | -0.011<br>(0.008)                                 | -0.009<br>(0.013)   |
| Unemployed                                   | 0.014+<br>(0.008)          | 0.006<br>(0.011)               | 0.000<br>(0.004)                               | -0.004<br>(0.006)  | -0.020<br>(0.015)                         | 0.001<br>(0.002)   | -0.001<br>(0.007)                                 | 0.008<br>(0.011)  |
| Other  | -0.006<br>(0.007)          | -0.009<br>(0.011)              | 0.002<br>(0.004)                               | -0.002<br>(0.006)  | 0.002<br>(0.016)                          | 0.004<br>(0.003)   | -0.002<br>(0.007)                                 | 0.010<br>(0.011)  |

Online Appendix Table 5

*Missing Patterns of Selected Outcome and Mechanism Variables (Continued)*

|  | Missing<br>English<br>midterm | Missing<br>“not<br>enjoying<br>life” | Missing “I am<br>always absent<br>from school” | Missing “I am<br>not close with<br>people in my<br>school” | Missing<br>expected years<br>of education | Missing “My<br>homeroom<br>teacher always<br>praises me” | Missing “My<br>class is in<br>good<br>atmosphere” | Missing “Having<br>friends with<br>general<br>disciplinary<br>problems” |
|--|-------------------------------|--------------------------------------|--|--|---|--|---|---|
|  | (1)                           | (2)                                  | (3)  | (4)  | (5)                                       | (6)  | (7)   | (8)   |
| <i>Father occupation</i>                     |                               |                                      |  |  |   |  |   |   |
| Executive and managerial                     | 0.006<br>(0.008)              | 0.011<br>(0.007)                     | 0.000<br>(0.002)                               | -0.001<br>(0.005)  | 0.001<br>(0.011)                          | 0.001<br>(0.001)   | 0.000<br>(0.005)                                  | 0.001<br>(0.007)  |
| Teachers, engineers, doctors, and<br>lawyers | -0.001<br>(0.007)             | 0.013<br>(0.010)                     | -0.002<br>(0.002)                              | -0.004<br>(0.004)  | 0.006<br>(0.011)                          | -0.001<br>(0.001)  | -0.003<br>(0.004)                                 | -0.003<br>(0.008)   |
| Technicians (including drivers)              | 0.003<br>(0.007)              | -0.003<br>(0.007)                    | 0.003<br>(0.003)                               | 0.001<br>(0.004)   | -0.007<br>(0.011)                         | -0.000<br>(0.001)  | 0.001<br>(0.004)                                  | 0.007<br>(0.007)  |
| Manufacturing workers                        | 0.000<br>(0.008)              | 0.002<br>(0.007)                     | 0.004<br>(0.003)                               | 0.002<br>(0.004)   | -0.006<br>(0.012)                         | -0.000<br>(0.001)  | 0.001<br>(0.005)                                  | 0.004<br>(0.007)  |
| Marketing, sales, and service                | 0.003<br>(0.008)              | 0.004<br>(0.007)                     | 0.004<br>(0.003)                               | 0.004<br>(0.004)   | 0.009<br>(0.012)                          | 0.004<br>(0.002)   | 0.005<br>(0.005)                                  | 0.014+<br>(0.008)   |
| Self-employed                                | -0.010<br>(0.007)             | -0.002<br>(0.007)                    | 0.003<br>(0.003)                               | 0.000<br>(0.004)   | 0.004<br>(0.011)                          | 0.002<br>(0.001)   | -0.003<br>(0.004)                                 | -0.000<br>(0.007)   |
| Farmers                                      | -0.023<br>(0.014)             | 0.004<br>(0.011)                     | 0.008+<br>(0.005)                              | 0.006<br>(0.006)   | -0.010<br>(0.012)                         | 0.003<br>(0.002)   | 0.005<br>(0.005)                                  | 0.006<br>(0.008)  |
| Unemployed                                   | -0.011<br>(0.009)             | 0.027<br>(0.017)                     | -0.001<br>(0.002)                              | -0.003<br>(0.004)  | -0.012<br>(0.018)                         | -0.002<br>(0.002)  | -0.005<br>(0.004)                                 | -0.001<br>(0.012)   |
| Other  | 0.015+<br>(0.009)             | 0.031*<br>(0.015)                    | 0.006+<br>(0.003)                              | 0.003<br>(0.004)   | -0.003<br>(0.011)                         | 0.004+<br>(0.002)  | 0.008<br>(0.005)                                  | 0.008<br>(0.008)  |
| <i>Family risk factors</i>                   |                               |                                      |  |  |   |  |   |   |
| At least one parent is absent from<br>home   | 0.007<br>(0.004)              | -0.005<br>(0.005)                    | -0.003<br>(0.003)                              | -0.004<br>(0.003)  | 0.010<br>(0.007)                          | -0.002<br>(0.003)  | -0.004<br>(0.003)                                 | -0.003<br>(0.005)   |
| Father gets drunk regularly                  | -0.001<br>(0.006)             | 0.003<br>(0.006)                     | -0.001<br>(0.003)                              | -0.001<br>(0.003)  | 0.033*<br>(0.013)                         | -0.001<br>(0.002)  | -0.002<br>(0.003)                                 | 0.002<br>(0.007)  |
| Parents always quarrel                       | -0.003<br>(0.006)             | -0.008<br>(0.005)                    | -0.000<br>(0.003)                              | -0.000<br>(0.003)  | 0.031**<br>(0.011)                        | -0.001<br>(0.002)  | -0.002<br>(0.003)                                 | 0.010<br>(0.008)  |
| Observations                                 | 7062                          | 7062                                 | 7062   | 7062   | 7062                                      | 7062   | 7062  | 7062  |

*Note:* Standard errors in parentheses. School FE models with student, teacher, and classroom peer controls. +  $p < 0.10$ , \*  $p < 0.05$ ,

\*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Online Appendix Table 6

*The Correlation between School Characteristics and School-level Variation in Repeater Assignment*

|  | Proportion of repeaters in school |
|--|-----------------------------------|
| Located in rural regions                       | -1.346<br>(3.255)                 |
| School size                                    | -0.005*<br>(0.003)                |
| Average class size                             | 0.142<br>(0.147)                  |
| Proportion of rural hukou students             | -0.009<br>(0.090)                 |
| School funding in the current year per student | -0.001<br>(0.002)                 |
| Proportion of low-income families              | 0.377**<br>(0.126)                |
| Average mother education                       | -3.732<br>(2.338)                 |
| Average father education                       | 0.559<br>(3.151)                  |
| Observations                                   | 93                                |
| R <sup>2</sup>                                 | 0.608                             |

*Note:* Located in rural regions, school size, average class size, and school funding in the current year per student (RMB) are from the school administrator's questionnaire. Proportion of rural hukou students, proportion of low-income families, average mother education, and average father education are calculated by taking the average score of the two classrooms per school in our sample. Standard errors in parentheses. <sup>+</sup>  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Online Appendix Table 7

*Impacts of Repeaters on Non-repeaters excluding Schools that Assigned Students Based on Parents' Requests: Outcomes and Mechanisms*

|   | 77 schools           |
|---|----------------------|
| <i>Panel A: Cognitive and noncognitive outcomes</i> |                      |
| Academic performance                                | -0.020***<br>(0.005) |
| Observations  | 5770                 |
| Cognitive assessment                                | -0.016*<br>(0.007)   |
| Observations  | 5889                 |
| Mental stress                                       | 0.001<br>(0.004)     |
| Observations  | 5766                 |
| School disengagement                                | 0.009**<br>(0.003)   |
| Observation   | 5859                 |
| Educational expectations                            | -0.001<br>(0.004)    |
| Observations  | 5847                 |
| <i>Panel B: Mechanisms</i>                          |                      |
| Positive student-teacher interaction                | -0.004<br>(0.003)    |
| Observations  | 5867                 |
| Positive student-student interaction                | -0.005<br>(0.005)    |
| Observations  | 5847                 |
| After-school study time (hours)                     | -0.007<br>(0.004)    |
| Observations  | 5401                 |
| Having friends with general disciplinary problems   | 0.001<br>(0.002)     |
| Observations  | 5783                 |
| Having friends who go to internet cafés             | 0.003+<br>(0.002)    |
| Observations  | 5771                 |

*Note:* We exclude 16 schools in which school administrators reported that parents requested the school to assign students to selected classrooms. Individual controls, homeroom teacher controls, and classroom average peer controls are added in each specification. Individual, homeroom teacher, and classroom average peer controls are the same with previous analyses. Standard errors in parentheses. <sup>+</sup>  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Online Appendix Table 8

*Randomization Check of Student Assignment with Predicted Cognitive Outcomes*

|                                  | Fitted<br>values for<br>Chinese<br>score<br>(1) | Fitted<br>values for<br>math score<br>(2) | Fitted values<br>for English<br>score<br>(3) | Fitted values<br>for cognitive<br>assessment<br>(4) |
|----------------------------------|---|---|--|---|
| Proportion of repeater peers (%) | -0.014<br>(0.008)                               | -0.016<br>(0.011)                         | -0.018+<br>(0.009)                           | -0.011<br>(0.009)                                   |
| Observations                     | 6939  | 6939                                      | 6939   | 7062  |
| R <sup>2</sup>                   | 0.515   | 0.723                                     | 0.667  | 0.734   |

*Note:* We create fitted values for Chinese, math, English, and cognitive assessment scores by regressing each score on all the controls, including individual controls, homeroom teacher controls, and classroom average peer controls. All models are school FE models. Standard errors in parentheses. <sup>+</sup>  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Online Appendix Table 9

*Correlation between Homeroom Teacher Characteristics and Classroom Average Student Characteristics*

|  | Homeroom<br>teacher<br>female<br>(1) | Homeroom<br>teacher age<br>in years<br>(2) | Homeroom<br>teacher<br>college<br>degree<br>(3) | Homeroom<br>teacher<br>experience<br>in years<br>(4) |
|--|--------------------------------------|--|---|--|
| Female   | 0.961<br>(1.502)                     | 13.427<br>(18.250)                         | -0.778<br>(1.517)                               | 19.113<br>(27.200)                                   |
| Urban hukou  | 1.179<br>(1.015)                     | -8.759<br>(16.521)                         | 0.280<br>(1.093)                                | -8.069<br>(20.093)                                   |
| Only child   | -0.490<br>(1.179)                    | -4.188<br>(15.102)                         | 0.362<br>(1.059)                                | -1.656<br>(23.742)                                   |
| Student age in years                                       | -1.026<br>(0.895)                    | -6.012<br>(10.709)                         | 0.080<br>(0.888)                                | 5.217<br>(16.690)                                    |
| Mother education in years                                  | -0.088<br>(0.232)                    | -1.069<br>(2.882)                          | 0.275<br>(0.189)                                | 1.485<br>(4.086)                                     |
| Father education in years                                  | -0.048<br>(0.203)                    | 1.091<br>(3.156)                           | -0.292<br>(0.193)                               | 0.087<br>(3.963)                                     |
| Low income   | -1.904<br>(1.317)                    | 1.599<br>(19.685)                          | 1.240<br>(1.824)                                | -13.234<br>(25.683)                                  |
| <i>Mother occupation</i>                                   |                                      |  |   |  |
| (Reference group: Civil servants and government officials) |                                      |  |   |  |
| Executive and managerial                                   | 1.494<br>(2.652)                     | 20.595<br>(32.554)                         | 0.802<br>(2.574)                                | 13.232<br>(51.767)                                   |
| Teachers, engineers, doctors, and lawyers                  | -0.142<br>(1.989)                    | -31.244<br>(35.495)                        | -0.691<br>(2.419)                               | -17.506<br>(47.681)                                  |
| Technicians (including drivers)                            | 0.778<br>(2.307)                     | -19.488<br>(30.961)                        | 0.767<br>(2.802)                                | -14.817<br>(38.513)                                  |
| Manufacturing workers                                      | 1.794<br>(1.479)                     | -11.576<br>(20.287)                        | 0.205<br>(1.548)                                | -35.420<br>(27.603)                                  |
| Marketing, sales, and service                              | -1.130<br>(1.497)                    | 17.841<br>(24.766)                         | 1.152<br>(1.776)                                | 17.139<br>(34.494)                                   |
| Self-employed  | 0.740<br>(1.848)                     | -5.692<br>(23.725)                         | 1.531<br>(2.152)                                | 1.848<br>(43.905)                                    |
| Farmers  | 0.470<br>(2.080)                     | 32.525<br>(31.168)                         | -1.449<br>(2.230)                               | 48.419<br>(41.664)                                   |
| Unemployed   | -1.751<br>(1.805)                    | -0.797<br>(23.230)                         | -2.236<br>(2.002)                               | 10.127<br>(37.700)                                   |
| Other  | -2.252<br>(2.623)                    | -2.218<br>(25.908)                         | -0.079<br>(2.119)                               | -23.072<br>(35.997)                                  |

Online Appendix Table 9

*Correlation between Homeroom Teacher Characteristics and Classroom Average Student Characteristics  
(Continued)*

|  | Homeroom<br>teacher<br>female | Homeroom<br>teacher age<br>in years | Homeroom<br>teacher<br>college<br>degree | Homeroom<br>teacher<br>experience in<br>years |
|--|-------------------------------|-------------------------------------|--|---|
|  | (1)                           | (2)                                 | (3)                                      | (4)   |
| <i>Father occupation</i>                                   |                               |                                     |  |   |
| (Reference group: Civil servants and government officials) |                               |                                     |  |   |
| Executive and managerial                                   | -0.080<br>(2.688)             | 7.553<br>(37.509)                   | 0.100<br>(2.636)                         | 12.707<br>(67.195)                            |
| Teachers, engineers, doctors, and lawyers                  | -1.355<br>(2.545)             | -14.075<br>(41.680)                 | -0.614<br>(3.046)                        | -40.718<br>(71.332)                           |
| Technicians (including drivers)                            | -1.657<br>(2.358)             | -22.633<br>(38.734)                 | 0.264<br>(2.336)                         | -30.509<br>(57.062)                           |
| Manufacturing workers                                      | -1.090<br>(2.294)             | -51.706<br>(38.282)                 | 1.806<br>(2.755)                         | -49.126<br>(58.775)                           |
| Marketing, sales, and service                              | 0.389<br>(3.416)              | -17.886<br>(50.106)                 | 0.763<br>(2.935)                         | -48.128<br>(74.075)                           |
| Self-employed  | -2.203<br>(2.392)             | -33.811<br>(33.771)                 | -0.057<br>(3.016)                        | -30.561<br>(50.875)                           |
| Farmers  | -1.875<br>(2.878)             | -70.828<br>(50.471)                 | 2.649<br>(3.107)                         | -71.939<br>(68.948)                           |
| Unemployed   | -1.960<br>(4.746)             | -58.813<br>(61.740)                 | -1.813<br>(4.796)                        | -35.244<br>(82.773)                           |
| Other  | 3.035<br>(4.678)              | -14.868<br>(51.027)                 | 4.082<br>(3.785)                         | 46.546<br>(97.446)                            |
| <i>Family risk factors</i>                                 |                               |                                     |  |   |
| At least one parent is absent from home                    | -0.231<br>(1.074)             | -22.344<br>(17.527)                 | -0.723<br>(1.212)                        | -17.655<br>(24.849)                           |
| Father gets drunk regularly                                | 0.384<br>(2.299)              | 8.898<br>(35.601)                   | -1.322<br>(1.882)                        | 14.350<br>(46.059)                            |
| Parents always quarrel                                     | -0.203<br>(1.749)             | 31.342<br>(27.228)                  | -1.073<br>(1.657)                        | 66.381+<br>(37.258)                           |
| Observations   | 183                           | 182                                 | 183                                      | 181   |

*Note:* Data collapsed to class level, so each observation is one class. 1 teacher is missing on age and 2 teachers are missing on experience. School FE models. Unstandardized coefficients. Standard errors in parentheses. +  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Online Appendix Table 10

*Correlation between School Characteristics and Within-School Variation in the Share of Repeaters*

|  | Within-school variation |
|--|-------------------------|
| Located in rural regions                             | -0.393<br>(1.574)       |
| School size  | -0.001<br>(0.001)       |
| Average class size                                   | -0.010<br>(0.073)       |
| Proportion of rural hukou students in school         | 0.002<br>(0.043)        |
| School funding in the current year per student (RMB) | -0.000<br>(0.001)       |
| Proportion of low-income families in school          | 0.016<br>(0.059)        |
| Average mother education                             | -1.524<br>(1.098)       |
| Average father education                             | 0.492<br>(1.489)        |
| Constant   | 16.948+<br>(9.613)      |
| Observations   | 90                      |
| R <sup>2</sup>                                       | 0.242                   |

*Note:* The variables located in rural regions, school size, average class size, and school funding in the current year per student (RMB) are from the school administrator's questionnaire. Proportion of rural hukou students in school, proportion of low-income families in school, average mother education, and average father education are calculated by taking the average score of the two classrooms per school in our sample. Standard errors in parentheses. <sup>+</sup>  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Online Appendix Table 11

*Multiple Hypotheses Testing of Main Outcomes and Mechanisms for all Repeaters, Male Repeaters, and Female Repeaters*

|  | Treatment: All repeaters        |                                 | Treatment: Male repeaters       |                                 | Treatment: Female repeaters     |                                 |
|--|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
|  | Original <i>p</i> -value<br>(1) | Adjusted <i>p</i> -value<br>(2) | Original <i>p</i> -value<br>(3) | Adjusted <i>p</i> -value<br>(4) | Original <i>p</i> -value<br>(5) | Adjusted <i>p</i> -value<br>(6) |
| <i>Panel A: Cognitive and non-cognitive outcomes</i> |                                 |                                 |                                 |                                 |                                 |                                 |
| Academic performance                                 | 0.000                           | 0.009                           | 0.000                           | 0.004                           | 0.220                           | 0.524                           |
| Cognitive assessment                                 | 0.000                           | 0.009                           | 0.004                           | 0.027                           | 0.014                           | 0.075                           |
| Mental stress  | 0.472                           | 0.437                           | 0.786                           | 0.774                           | 0.476                           | 0.601                           |
| School disengagement                                 | 0.020                           | 0.061                           | 0.061                           | 0.146                           | 0.226                           | 0.524                           |
| Educational expectations                             | 0.179                           | 0.273                           | 0.098                           | 0.166                           | 0.409                           | 0.601                           |
| <i>Panel B: Mechanisms</i>                           |                                 |                                 |                                 |                                 |                                 |                                 |
| Positive student-teacher interaction                 | 0.406                           | 0.695                           | 0.693                           | 0.649                           | 0.222                           | 0.375                           |
| Positive student-student interaction                 | 0.496                           | 0.695                           | 0.085                           | 0.140                           | 0.149                           | 0.375                           |
| After-school study time (hours)                      | 0.004                           | 0.034                           | 0.028                           | 0.088                           | 0.142                           | 0.375                           |
| Having friends with general disciplinary problems    | 0.563                           | 0.695                           | 0.002                           | 0.029                           | 0.014                           | 0.064                           |
| Having friends who go to internet cafés              | 0.362                           | 0.695                           | 0.010                           | 0.054                           | 0.625                           | 0.610                           |

*Note:* *p*-values of coefficients are shown in this table. *P*-value adjustments are for regressions with the full set of controls and school FE in Tables 4, 5, and 7.

Online Appendix Table 12

*Impacts of Repeaters on Non-repeaters for Urban and Rural School Subsamples: Outcomes and Mechanisms*

|   | Schools located<br>in rural regions<br>(1) | Schools located<br>in urban regions<br>(2) |
|---|--|--|
| <i>Panel A: Cognitive and noncognitive outcomes</i> |  |  |
| Academic performance                                | -0.026**<br>(0.007)                        | -0.029***<br>(0.008)                       |
| Observations  | 2039                                       | 4900                                       |
| Cognitive assessment                                | -0.023**<br>(0.008)                        | -0.024**<br>(0.008)                        |
| Observations  | 2073                                       | 4989                                       |
| Mental stress                                       | 0.006<br>(0.005)                           | 0.012**<br>(0.005)                         |
| Observations  | 2031                                       | 4873                                       |
| School disengagement                                | 0.007*<br>(0.003)                          | 0.007<br>(0.005)                           |
| Observations  | 2062                                       | 4967                                       |
| Educational expectations                            | -0.011<br>(0.006)                          | -0.010*<br>(0.004)                         |
| Observations  | 2064                                       | 4956                                       |
| <i>Panel B: Mechanisms</i>                          |  |  |
| Positive student-teacher interaction                | -0.005<br>(0.006)                          | -0.009*<br>(0.004)                         |
| Observations  | 2065                                       | 4973                                       |
| Positive student-student interaction                | -0.002<br>(0.005)                          | -0.014*<br>(0.006)                         |
| Observations  | 2058                                       | 4958                                       |
| After-school study time (hours)                     | -0.010<br>(0.006)                          | -0.001<br>(0.006)                          |
| Observations  | 1936                                       | 4562                                       |
| Having friends with general disciplinary problems   | 0.005<br>(0.002)                           | 0.004<br>(0.003)                           |
| Observations  | 2046                                       | 4897                                       |
| Having friends who go to internet cafés             | 0.002<br>(0.002)                           | 0.002<br>(0.002)                           |
| Observations  | 2042                                       | 4887                                       |

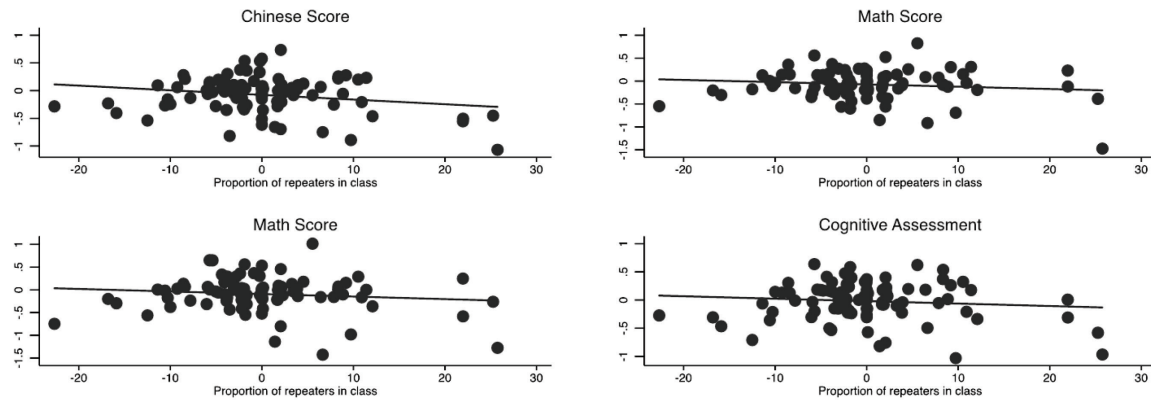
*Note:* All outcome variables are standardized within non-repeaters within each school. Individual controls, homeroom teacher controls, and classroom average peer controls are included in each specification. Individual controls include gender, hukou status, only child, age, parental educational attainment, parental occupations, family income, and family risk factors. Homeroom teacher controls include gender, age, educational level, graduated from a normal university, have a teaching certificate, teaching experience in years, teaching title, and teaching award. Classroom average peer controls include class size, percentage of boys, percentage of low-income families, and percentage of students who have at least one family risk factor. School FE models. Standard errors in parentheses. <sup>+</sup>  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Online Appendix Table 13

*Descriptive Statistics of Outcome and Mechanism Variables by Gender*

|   | Repeaters          |                    | Non-repeaters      |                    |
|---|--------------------|--------------------|--------------------|--------------------|
|   | Male<br>(1)        | Female<br>(2)      | Male<br>(3)        | Female<br>(4)      |
| Academic performance                              | 66.136<br>(22.100) | 73.610<br>(20.958) | 77.129<br>(22.234) | 84.501<br>(19.492) |
| Cognitive assessment                              | 9.175<br>(3.301)   | 8.852<br>(3.153)   | 11.043<br>(3.504)  | 11.126<br>(3.345)  |
| Mental stress                                     | 2.152<br>(0.815)   | 2.217<br>(0.750)   | 1.958<br>(0.841)   | 1.985<br>(0.769)   |
| School disengagement                              | 1.829<br>(0.502)   | 1.750<br>(0.475)   | 1.580<br>(0.471)   | 1.523<br>(0.443)   |
| Educational expectations                          | 14.943<br>(3.591)  | 15.626<br>(3.189)  | 16.534<br>(3.178)  | 16.927<br>(2.721)  |
| Confidence about future                           | 3.112<br>(0.764)   | 3.144<br>(0.744)   | 3.338<br>(0.690)   | 3.321<br>(0.677)   |
| Positive student-teacher interaction              | 2.534<br>(0.633)   | 2.597<br>(0.621)   | 2.731<br>(0.634)   | 2.764<br>(0.605)   |
| Positive student-student interaction              | 2.982<br>(0.772)   | 3.027<br>(0.777)   | 3.186<br>(0.766)   | 3.317<br>(0.691)   |
| After-school study time (hours)                   | 1.174<br>(1.192)   | 1.288<br>(1.018)   | 1.302<br>(1.024)   | 1.364<br>(0.993)   |
| Having friends with general disciplinary problems | 0.461<br>(0.499)   | 0.151<br>(0.359)   | 0.288<br>(0.453)   | 0.091<br>(0.287)   |
| Having friends who go to internet cafés           | 0.325<br>(0.469)   | 0.055<br>(0.228)   | 0.137<br>(0.344)   | 0.032<br>(0.177)   |
| Observations                                      | 785                | 561                | 3558               | 3386               |

*Note:* Standard deviations in parentheses. Observations are restricted to students who are non-missing on gender.



Online Appendix Figure 1

*Prediction of Main Outcomes for Non-Repeaters based on the Proportion of Repeaters in Class*

*Note:* School FE models. We also tested other outcome variables, finding a flat line for each variable.