# Online appendix for ”High-Stakes Grades and Student Behavior”

**Bevis for Studentereksamen (stx)**
Aflagt i henhold til lovgivningen om de gymnasiale uddannelser

Navn: [redacted]
Cpr. nr: [redacted]
Eksamen er afsluttet juni 2008

| | Årskarakterer | | | Prøvekarakterer | | | Særlige oplysninger | | |
|---|---|---|---|---|---|---|---|---|---|
| Fag | Vægt | Karakter | ECTS | Vægt | Karakter | ECTS | Institution | Termin | Merit |
| Dansk A, mdt. | 1 | 10 | B | - | - | - | | | |
| Dansk A, skr. | 1 | 10 | B | 1 | 10 | B | | | |
| Engelsk A, mdt. | 1 | 10 | B | - | - | - | | | |
| Engelsk A, skr. | 1 | 10 | B | 1 | 10 | B | | | |
| Historie A | 2 | 10 | B | 2 | 12 | A | | | |
| Samfundsfag A, mdt. | 1 | 10 | B | - | - | - | | | |
| Samfundsfag A, skr. | 1 | 12 | A | 1 | 10 | B | | | |
| Spansk A, mdt. | 1 | 10 | B | 1 | 12 | A | | | |
| Spansk A, skr. | 1 | 10 | B | - | - | - | | | |
| Biologi B, mdt. | 0,75 | 10 | B | - | - | - | | | |
| Biologi B, skr. | 0,75 | 10 | B | - | - | - | | | |
| Matematik B, mdt. | 0,75 | 10 | B | 0,75 | 12 | A | | | |
| Matematik B, skr. | 0,75 | 12 | A | 0,75 | 7 | C | | | |
| Fysik C | 1 | 10 | B | - | - | - | | | |
| Idræt C | 1 | 7 | C | - | - | - | | | |
| Musik C | 1 | 7* | C | - | - | - | | | |
| Naturgeografi C | 1 | 10 | B | 1 | 10 | B | | | |
| Oldtidskundskab C | 1 | 7 | C | 1 | 12 | A | | | |
| Religion C | 1 | 10 | B | - | - | - | | | |
| Almen studieforberedelse | - | - | - | 2 | 10 | B | | | |
| Studieretningsprojektet | - | - | - | 2 | 10 | B | | | |

Studieretning: Engelsk A, Samfundsfag A, Matematik B

Studieretningsprojekt: Engelsk, Samfundsfag

Almen studieforberedelse: Dansk, Samfundsfag

Foreløbigt eksamensresultat: **10,1**
Eksamensresultat: **10,4**

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Silkeborg Gymnasium

**Figure A.1**
High School Diploma for the Treated Cohort (2008 Graduates)

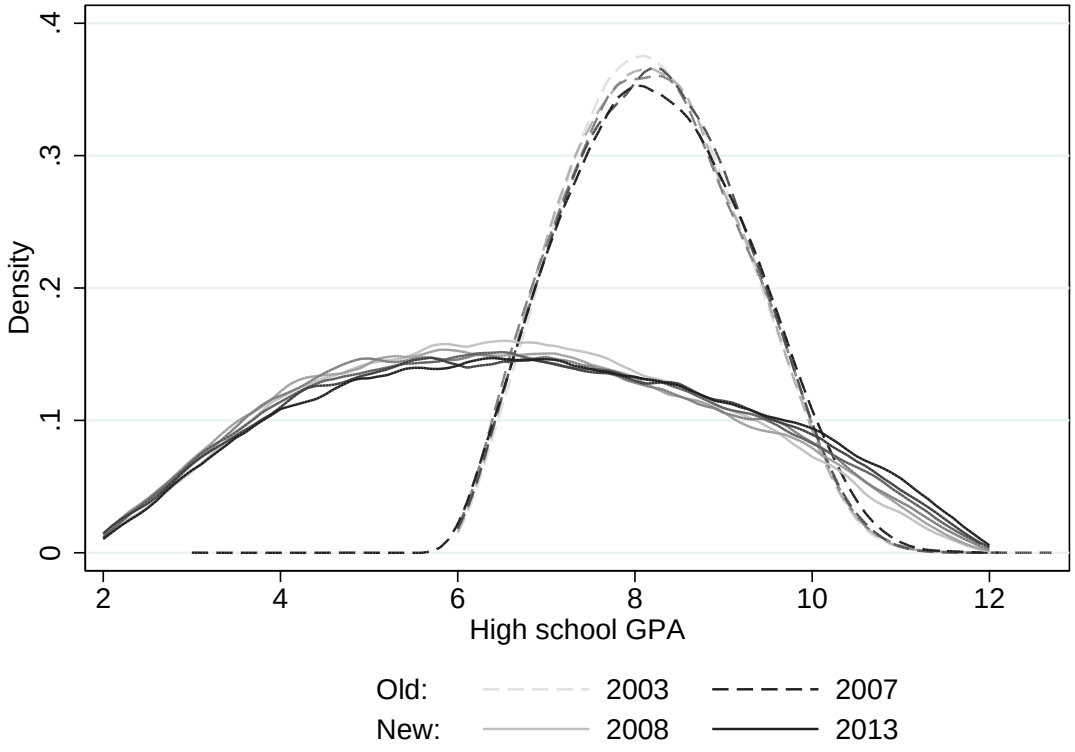



**Figure A.2**
High School GPA by Graduation Year.

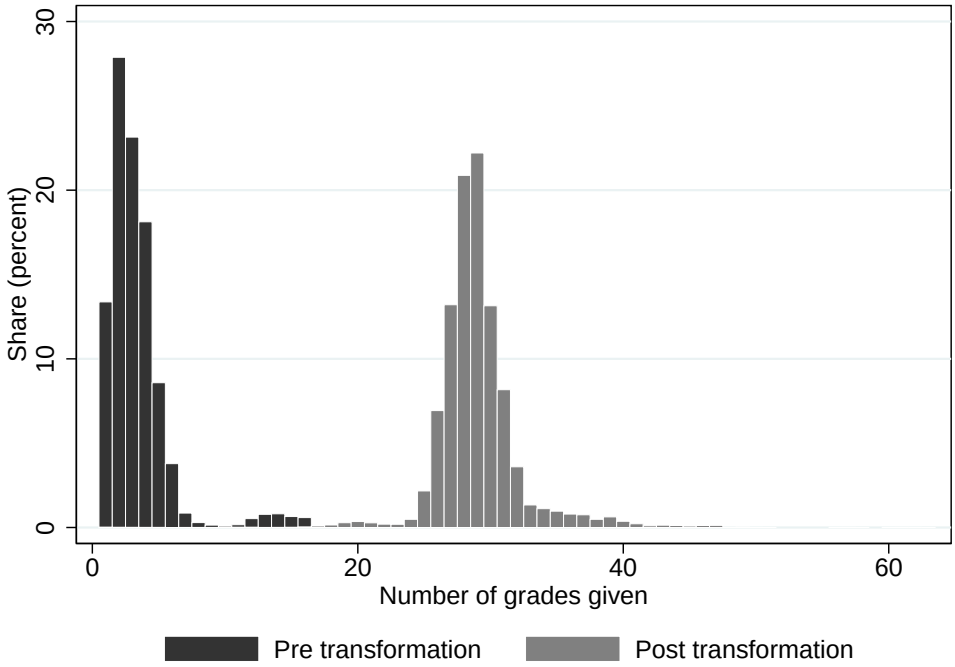
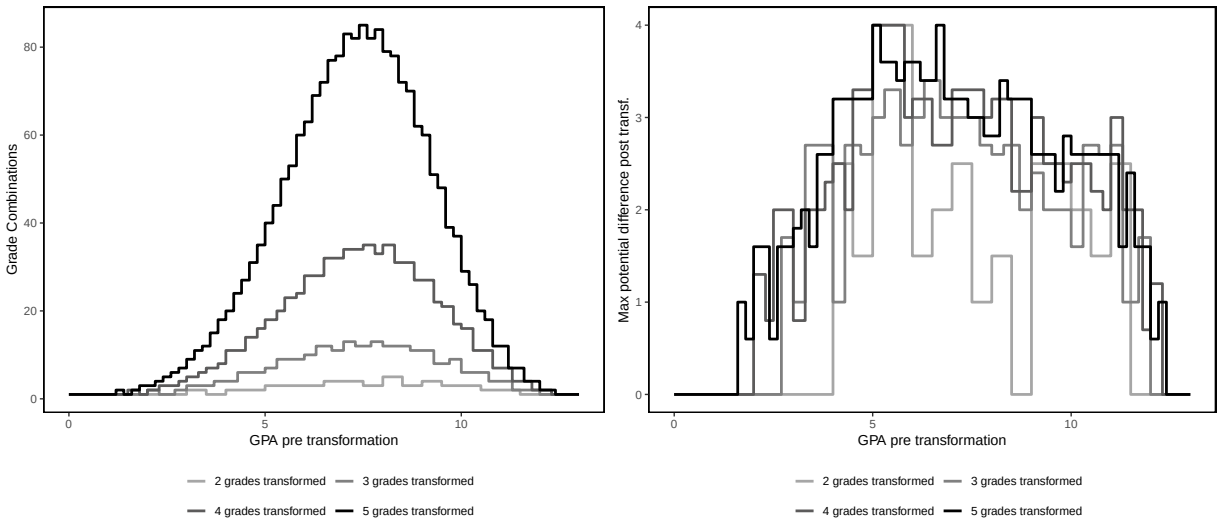


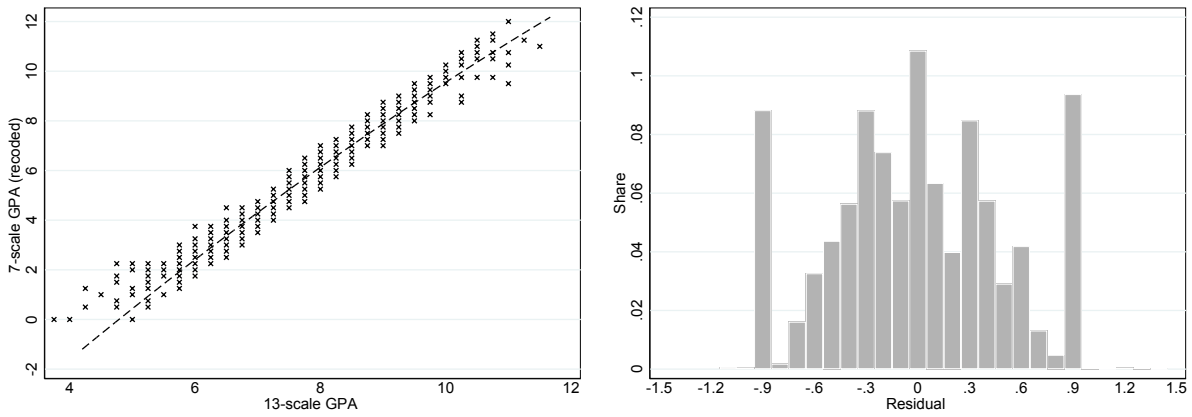

**Figure A.3**
The Number of Grades Given Before and After the Recoding.




**(a)** Grade combinations

**(b)** Maximum difference in post-recoding GPA

**Figure A.4**
The Theoretical Number of Grade Combinations and the Maximum Difference Between Pre- and Post-Recoded GPA, Given GPA and Number of Transformed Grades.




**(a)** Pre- and post-recoding GPA

**(b)** Residuals and post-recoding GPA

**Figure A.5**
Pre- and Post-Recoding GPA of First-Year Grades.

Notes: Only combinations with at least three observations are shown.

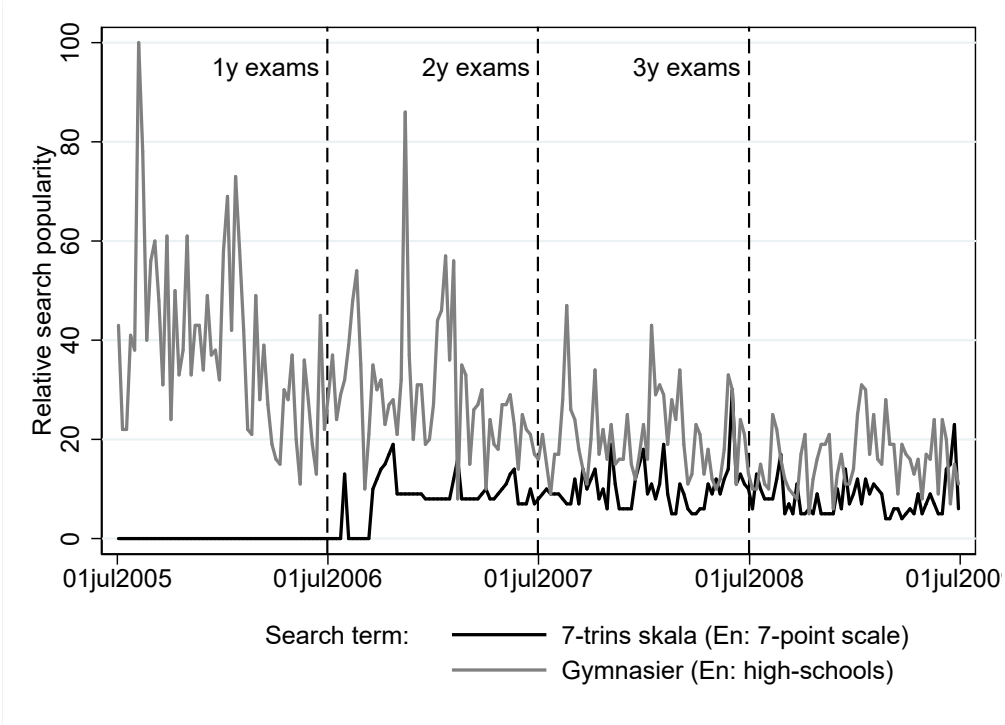
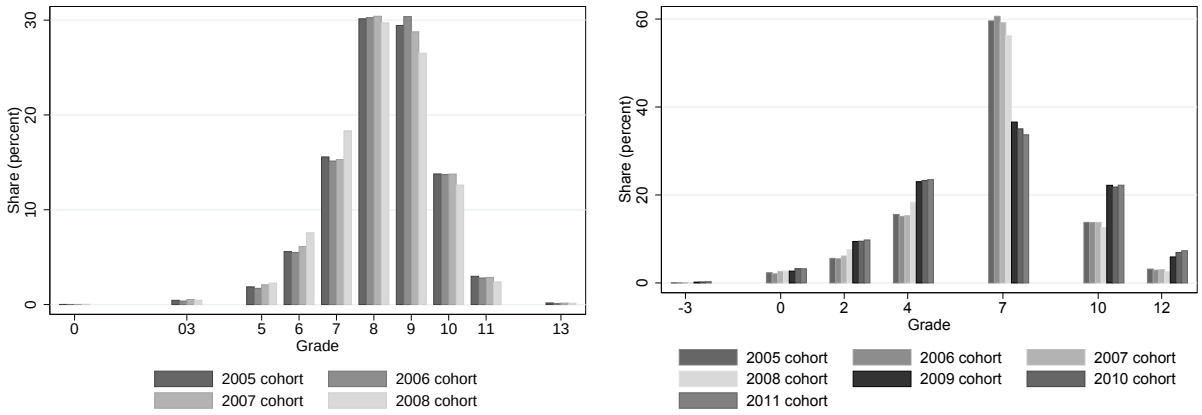



**Figure A.6**
Google Search Trend 2005-2009. The popularity is measured relative to the most popular search time/term for the period, which is set to 100.




**(a)** 13 scale

**(b)** Transformed to 7-point scale

**Figure A.7**
Grading Patterns of 1st Year Grades by High School Graduation Year.

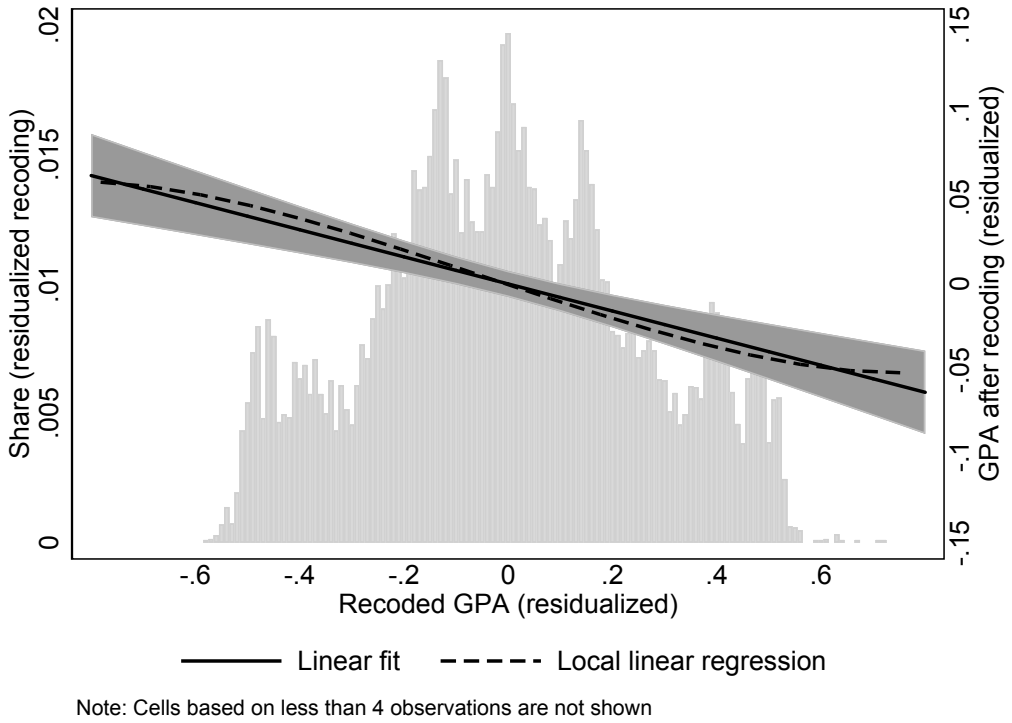



**Figure A.8**
The Relationship Between the Reform-Induced GPA Shock and Subsequent Grades.

Notes: The graph shows the relationship between the residuals from regressing the recoded GPA and the GPA for subsequent grades on all covariates, a second-order polynomial in the first-year grades before the recoding and school fixed effects. The dashed line shows the local linear regression using a Gaussian kernel, a bandwidth of 0.5 and a degree of 1. The solid line shows the linear fit using ordinary least squares (corresponding to the estimated relationships presented in Table 6). The gray shaded area shows the 95 percent confidence interval obtained with the delta method. The gray bars show the fraction of the observations (in percent). The graph excludes the bottom and top 1 percent of the residuals from the recoded GPA, but the local linear regression and the global linear regression lines are fitted on the full sample.

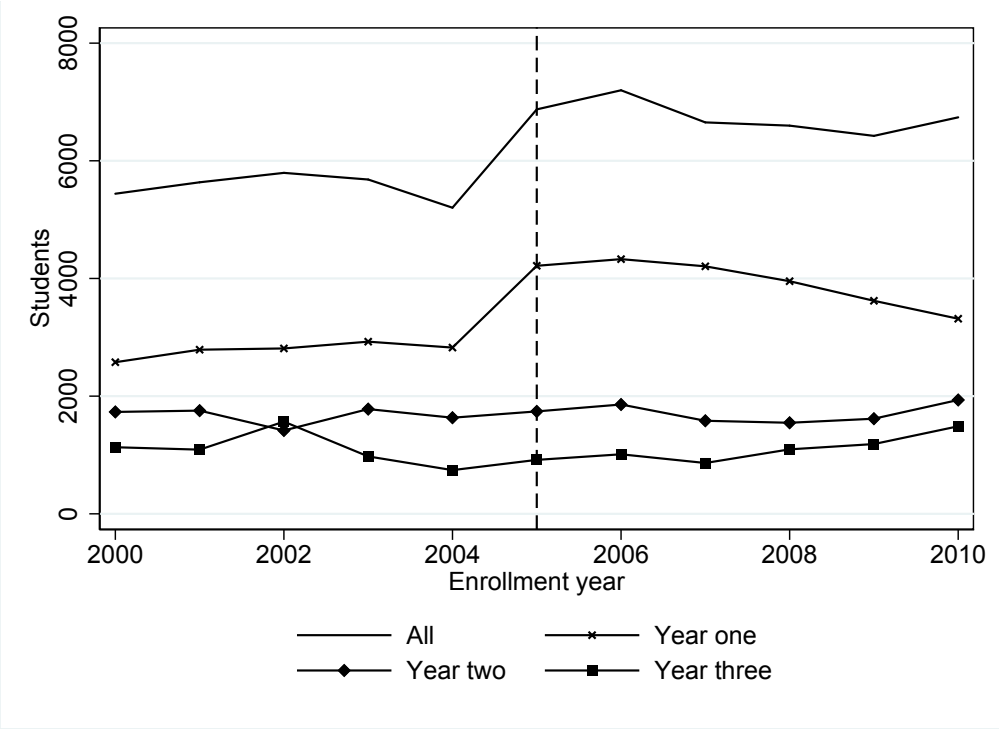



**Figure A.9**
High School Enrollment and Dropouts by Year of Enrollment, Divided into Groups According to the High School Year They Dropped Out of High School.

## A Does Student Labor Supply Respond to the Shock in Grades?

We merge the main data to records on their labor market attachment during high school. We measure the labor supply for the calendar year 2007, which corresponds to the second half of the second high school year and the first half of the third (and last) high school year.

Panel A of Table A.3 shows the results from using an indicator for whether the individual worked for income as the dependent variable. Around 86 percent of the high school cohort worked during high school. There is no evidence of an effect of the GPA shock on this extensive margin of labor supply. However, Panel B of Table A.3 shows that students reacted on the intensive margin. Using gross labor income measured in €1,000 Euro (2015 level) as the dependent variable, we find that students who received a positive GPA shock increased their labor income by, on average, €66 (corresponding to an increase of 1.1 percent, evaluated at the sample mean). That is, students

**Table A.1**
Regression Results for the Effect of a GPA Shock on the Probability of Delaying. Dependent Variable: Delayed Graduation.

| | | 9th Grade GPA | | Gender | | Parental educ. | |
|---|---|---|---|---|---|---|---|
| | Main | Low | High | Boys | Girls | Low | High |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Recoded GPA | -0.001 | 0.004 | -0.005 | 0.009 | -0.006 | -0.007 | 0.005 |
| | (0.004) | (0.008) | (0.005) | (0.008) | (0.006) | (0.007) | (0.006) |
| P-value | | 0.36 | | 0.15 | | 0.16 | |
| Mean of dependent variable | 0.05 | 0.07 | 0.04 | 0.06 | 0.05 | 0.05 | 0.05 |

Notes: The table shows point estimates and standard errors for $\beta_1$ in equation (1), estimated with ordinary least squares. The dependent variable is denoted in the column header. The GPA is standardized to have a mean of zero and a unit standard deviation. We control for the first-year GPA before the recoding using a second-order polynomial. The covariates included are age at high school entry, gender, ninth grade GPA (standardized) origin (indicator for non-Western origin), parental education (years of completed education, average across parents), income (disposable income, average across parents), and the number of non-missing parental education and income observations (indicators). All parental variables are measured in the calendar year before the focal individual enrolled in high school. Standard errors clustered on the school level in parentheses.

who were downgraded due to the reform reduced the time spent on other activities. An alternative conceivable mechanism would be that students who were downgraded responded by improving their educational achievement, which allowed them to work on the side. Moreover, student could potentially shift to better paying jobs in response to the grade shock. Nevertheless, the fact that we only find an effect on the intensive margin (and not the extensive margin) supports the notion that labor supply works as a mediator.

Although the subsample analysis in Panel B shows that the coefficients for all subgroups are positive, the labor supply response appears to vary somewhat in magnitude across subgroups. There is a relatively large labor supply response among students with parents with an average length of education below the median, which is in line with the main results that showed that this group also experienced a performance improvement in response to a negative shock. However, there is also some evidence of a larger labor supply response for students with a below-median middle school GPA than for students with an above-median GPA. Although the difference is not statistically significant at the 5 percent level, this pattern is in contrast to the performance response, suggesting that the relationship between educational improvements and time spent on work along-

**Table A.2**
Regression Results for the Effect of a GPA Shock on Subsequent Grades: Dependent variable: Grades Given After Recoding (Standardized), with Coefficients for Original GPA.

| | | 9th Grade GPA | | Gender | | Parental educ. | |
|---|---|---|---|---|---|---|---|
| | Main | Low | High | Boys | Girls | Low | High |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Recoded GPA | -0.079 | -0.031 | -0.096 | -0.041 | -0.106 | -0.062 | -0.091 |
| | (0.017) | (0.025) | (0.021) | (0.027) | (0.021) | (0.024) | (0.022) |
| P-value | | 0.03 | | 0.04 | | 0.32 | |
| Original GPA | 0.483 | 0.458 | 0.508 | 0.470 | 0.489 | 0.494 | 0.470 |
| | (0.019) | (0.027) | (0.023) | (0.029) | (0.023) | (0.027) | (0.023) |
| Original GPA squared | 0.052 | 0.070 | 0.014 | 0.059 | 0.046 | 0.068 | 0.040 |
| | (0.004) | (0.006) | (0.006) | (0.005) | (0.004) | (0.005) | (0.005) |
| Mean of dependent variable | -0.00 | -0.54 | 0.53 | -0.09 | 0.07 | -0.16 | 0.18 |
| Observations | 26,759 | 13,218 | 13,538 | 11,677 | 15,080 | 11,414 | 13,628 |
| Clusters | 209 | 208 | 207 | 207 | 208 | 209 | 208 |
| $R^2$ | 0.60 | 0.39 | 0.51 | 0.59 | 0.62 | 0.57 | 0.61 |

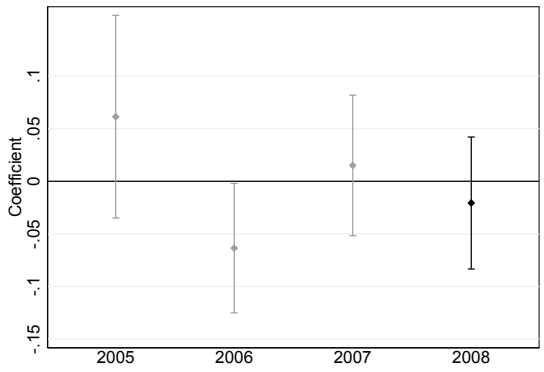
Notes: The table shows point estimates and standard errors for $\beta_1$ in equation (1), estimated with ordinary least squares. The dependent variable is denoted in the column header. The GPA is standardized to have a mean of zero and a unit standard deviation. We control for the first-year GPA before the recoding using a second-order polynomial. The covariates included are age at high school entry, gender, ninth grade GPA (standardized) origin (indicator for non-Western origin), parental education (years of completed education, average across parents), income (disposable income, average across parents), and the number of non-missing parental education and income observations (indicators). All parental variables are measured in the calendar year before the focal individual enrolled in high school. Standard errors clustered on the school level in parentheses.

side studying is complex, and affected by demographic characteristics. Finally, we do not find that girls and boys differ in their response in terms of their labor supply. Thus, the subgroup analyses suggest that the relationship between educational improvements and time spent on a job may be somewhat more complicated.

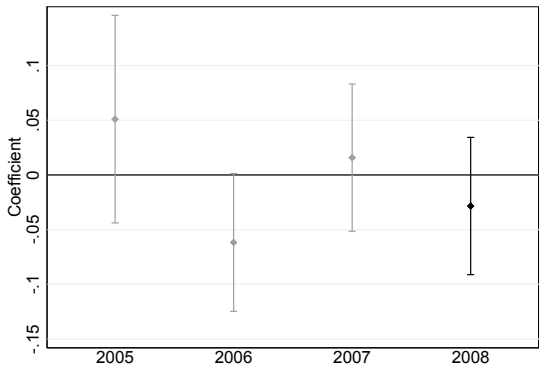
**Table A.3**
Regression Results for Labor Supply Mechanisms.

| | | 9th Grade GPA | | Gender | | Parental educ. | |
|---|---|---|---|---|---|---|---|
| | Main | Low | High | Boys | Girls | Low | High |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| *A. Dependent variable: labor income > 0* | | | | | | | |
| Recoded GPA | 0.002 | 0.009 | -0.003 | 0.009 | -0.001 | 0.006 | -0.004 |
| | (0.008) | (0.011) | (0.012) | (0.012) | (0.010) | (0.013) | (0.011) |
| P-value | | 0.46 | | 0.50 | | 0.56 | |
| Mean of dependent variable | 0.86 | 0.86 | 0.86 | 0.82 | 0.89 | 0.88 | 0.84 |
| *B. Dependent variable: labor income (€1,000)* | | | | | | | |
| Recoded GPA | 0.251 | 0.409 | 0.083 | 0.234 | 0.236 | 0.406 | 0.072 |
| | (0.087) | (0.132) | (0.119) | (0.153) | (0.108) | (0.129) | (0.122) |
| P-value | | 0.07 | | 0.99 | | 0.06 | |
| Mean of dependent variable | 5.75 | 6.23 | 5.29 | 5.85 | 5.68 | 6.23 | 5.30 |

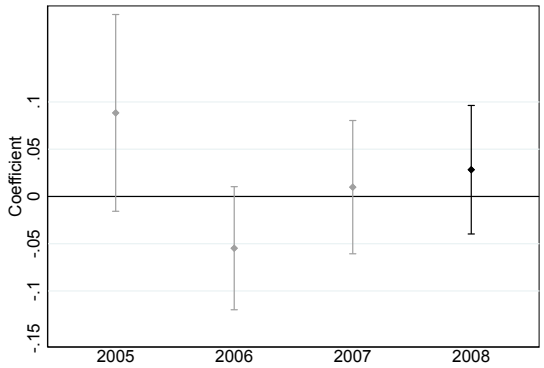
Notes: The table shows point estimates and standard errors for $\beta_1$ in Equation (1), estimated with ordinary least squares. See notes for Table 6.



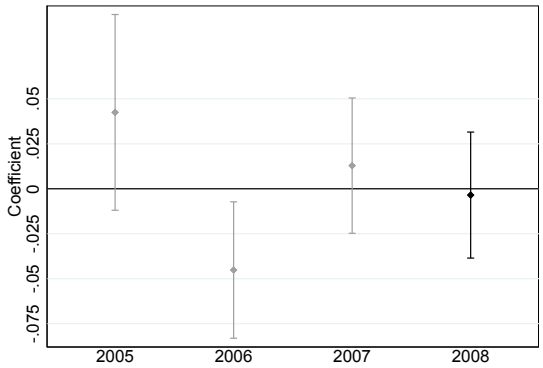

**(a)** Grades given after recoding



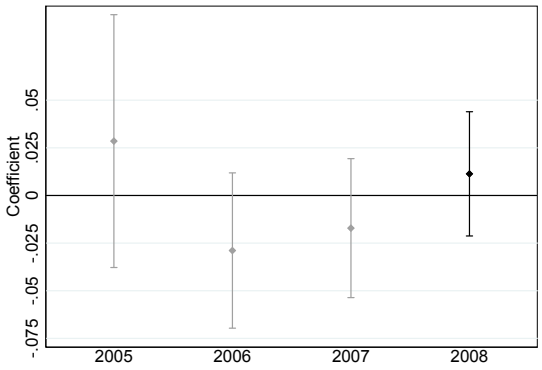

**(b)** Internal grades




**(c)** External grades



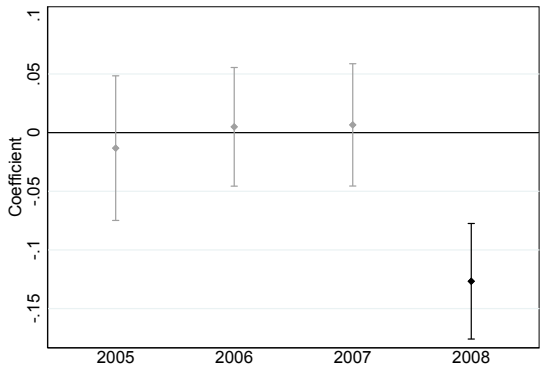

**(d)** Enrolled in university



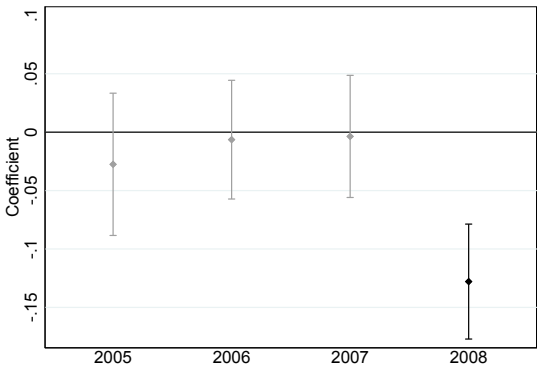

**(e)** Graduated from university

**Figure A.10**
Placebo Tests: Boys. Estimates of $\beta_1$ Based on Equation (1), by High School Cohort.

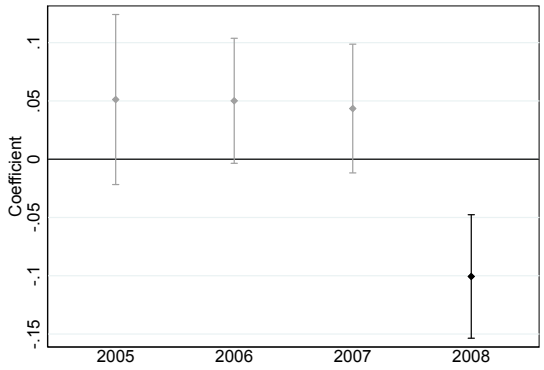
Notes: 2005-2007 are untreated cohorts, and 2008 is the treated cohort. As the data do not include covariates for the 2005-2007 cohorts, all specifications are estimated without covariates, but with school fixed effects.



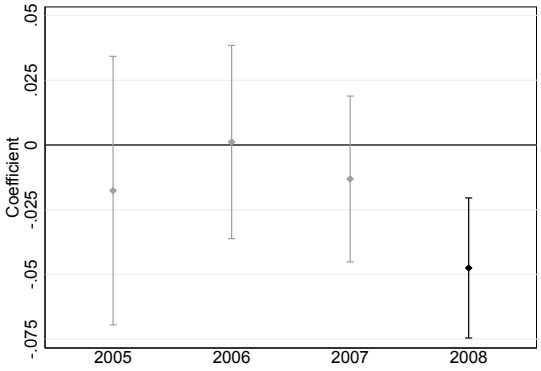

**(a)** Grades given after recoding



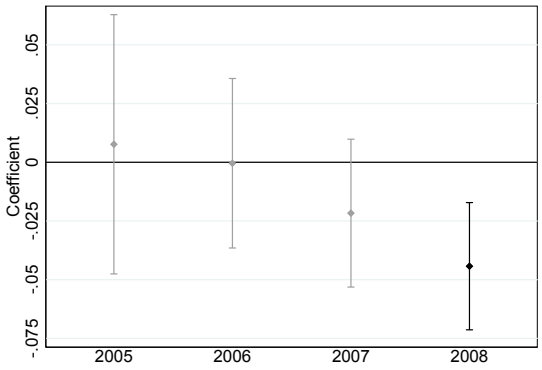

**(b)** Internal grades




**(c)** External grades




**(d)** Enrolled in university




**(e)** Graduated from university

**Figure A.11**
Placebo Tests: Girls. Estimates of $\beta_1$ Based on Equation (1), by High School Cohort.

Notes: 2005-2007 are untreated cohorts, and 2008 is the treated cohort. As the data do not include covariates for the 2005-2007 cohorts, all specifications are estimated without covariates, but with school fixed effects.