Regression II
Vanderbilt University
Prof. Sean P. Corcoran **88 total points**

Problem Set 3 *Solutions*

Question 1. This problem will use regression difference-in-differences to estimate the impact of a breakfast in the classroom (BIC) program on school meals program participation in New York City. BIC was not implemented under random assignment; rather, schools voluntarily adopted the program. We do, however, have data for these and other schools before and after adoption. (See Corcoran, Elbel, & Schwartz 2015 for details). (**51 points**)

(a) In Stata, open the panel dataset called *NYCbkfastlunch.dta* from Github:

```
use https://github.com/spcorcor18/LPO-8852/raw/main/data/NYCbkfastlunch.dta, clear
```

This file consists of school-level data in which the rows are elementary or middle schools observed in year t (t=2005 to 2012). The outcome variables of interest are *bkfast_part* and *lunch_part*, which are average daily participation rates in the school breakfast and lunch programs. Provide some descriptive statistics for these two variables. On what scale are they measured? (**2 points**)

See below and attached log. Each of the outcome variables ranges between 0-1 and can be interpreted as the proportion of students in attendance on the average school day in school i who received a breakfast or lunch. The average daily participation was 0.777 (or 77.7%) for lunch and only 0.259 (or 25.9%) for breakfast.

```
. // #1
. summ bkfast_part lunch_part

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
 bkfast_part |      8,061    .2594672    .1446061   .0054945   .9759036
  lunch_part |      7,790    .7767745    .1836831   .0122249          1
```

(b) Stata has a set of `xt` commands that make working with panel data easier. Use `xtset` *`panelvar timevar`* to declare the data as a panel. Which variable is the cross-sectional unit (*panelvar*) and which is the time dimension (*timevar*)? Is this a balanced panel? (Use `xtdescribe` to inspect the panel balance). How many schools are observed in all 8 years? (**2 points**)

See attached log. *schoolid* is the cross-sectional unit, while *year* is the time dimension. This is not a balanced panel, as schools vary in the number of years of data available. This is easily seen in `xtdescribe` which shows the pattern of data availability. 957 schools (or 81.1%) have data in all 8 years.

(c) This dataset contains three types of schools: (1) schools that adopted BIC in 2010 *(bic2010==1)*, (2) schools that never adopted BIC *(bicever==0)*, and (3) schools that adopted BIC in a year other than 2010 *(bic2010==0 & bicever==1)*. For parts (c)-(i) we will only work with types (1) and (2). Think of (1) as the treated group and (2) as the untreated group. We are excluding type (3) for now so that the "pre" and "post" periods are clearly defined.

Estimate a difference-in-differences regression that compares mean breakfast participation for the treated and untreated groups in two time periods: before 2010 and 2010-2012. (In other words, do a simple pre-post comparison for the two groups). Do the same for lunch participation. Interpret your results. Did the adoption of BIC have an impact on breakfast or lunch program participation? Is the effect statistically significant? Practically significant? What assumption(s) must be satisfied for this difference-in-differences to be considered a causal effect? (**6 points**)

See attached log. The difference-in-differences (*bic2010* x *post2010*) is positive and statistically significant for breakfast, and statistically insignificant for lunch. In the case of breakfast, average daily participation increased 22.2 percentage points more in schools that adopted BIC (the treated schools) relative to did schools that did not adopt BIC (the untreated schools).

For this estimate to be considered causal, the common trends assumption must be satisfied. That is, the pre-post change in breakfast participation among non-BIC schools must represent what would have occurred in BIC schools had they not been "treated" by adopting the program.

(d) Compare the mean characteristics of treated and untreated schools. Look at the following: total enrollment, % ELL, % special education, % Asian, % black, % Hispanic, % female, % free lunch eligible (*free1*), % reduced price lunch eligible (*redu1*). How do schools that adopted BIC compare to those that didn't? (**4 points**)

See attached log. It is clear that schools which adopted BIC in 2010 differ systematically from those that didn't. They are more disadvantaged on a number of dimensions, including %ELL, %sped, and percent with family income low enough to be eligible for free meals. These differences suggest we should include these covariates in the regressions. Others—such as the race or gender composition of the school—may also help to reduce unexplained variation in the outcome.

(e) Now estimate the same regression models in part (c), but include the school covariates listed above. How do your estimates of the "BIC effect" change, if at all? (And how are these covariates related to meal participation?) (**4 points**)

See attached log. It appears the inclusion of covariates has little effect on the difference-in-differences estimates for breakfast and lunch participation.

Many of the included covariates are related to meals program participation. For example, *%ELL, %sped*, and percent eligible for free meals are all positively related to breakfast participation. *Total enrollment, Asian, Hispanic*, and *female* shares are all negatively related to breakfast participation.

(f) Repeat parts (c) and (e), but include a linear time trend in the regression. Center your time variable to be equal to 0 in 2010. How does this affect your impact estimates for BIC, if at all? What assumption(s) must be satisfied for this difference-in-differences to be considered a causal effect? (**4 points**)

See attached log. Note I first re-centered the *year* variable so that the implementation year (2010) equals zero. (This is arbitrary—one could also let the *time* variable be equal to zero in 2005). The positive and statistically significant time trend in the breakfast models suggests a small but secular trend in breakfast participation. Inclusion of the time trend appears to have had little effect on the difference-in-differences estimates, however, regardless of whether covariates are included. In the first model the estimated coefficient of 0.007 on *time* is interpreted as a 0.007 predicted increase in mean breakfast participation each year, holding other variables in the model constant. For the difference-in-differences estimate to be considered causal, the common trends assumption must hold. That is, *conditional on the linear time trend and other covariates in the model*, pre-post change in breakfast participation among non-BIC schools must represent what would have occurred in BIC schools had they not bee treated.

(g) Repeat part (f) but use year dummies in the regression model in place of the linear time trend. How does this affect your impact estimates for BIC, if at all? Explain why one of the post-2010 year effects is not estimable. (**4 points**)

See attached log. The year dummies are a more flexible way of capturing annual fluctuations in mean breakfast (or lunch) participation. Their use in this case has little impact on the difference-in-differences estimate. Note that one of the post-2010 year effects is omitted. This is because of perfect collinearity between the *post2010* variable and the three dummies for 2010, 2011, and 2012. (If you know three of these variables, the fourth is also known).

(h) Next, estimate a two-way fixed effects version of the models in (g). One way to do this is to include separate dummy variables for every school. A preferable approach is to use `xtreg` with the `fe` option. (Be sure you have used the `xtset` command in part b). How do your estimates compare to those in (g)? (**5 points**)

See attached log. When we used `xtset` in (b), we told Stata that *schoolid* is the cross-sectional unit. The command `xtreg` with the `fe` option estimates

a fixed-effects version of the model. Effectively, each *schoolid* has its own intercept and the BIC effect is estimated using within-school variation in treatment (BIC or not) and within-school variation in meals program participation. This is analogous to the state and year effects MLDA model considered in the in-class exercise. Note the *bic2010* variable is dropped from the estimation since it is perfectly collinear with the school effects. (It is =1 in all years for schools that adopted BIC in 2010). The point estimate for the effect of BIC on breakfast participation is very similar to earlier model specifications: schools that adopted BIC saw their breakfast participation rate increase by 24.4 percentage points more than schools that did not adopt BIC.

(i) One way to test the common trends assumption (for the pre-period) is to fit an "event study" regression, which estimates a treatment-comparison group difference in every year. To do this, estimate the model described in (h), but instead of the usual difference-in-differences variables, include an interaction of *bic2010* and the year dummies. Use the year prior to treatment as the reference year. How should you interpret the *bic2010*year* interaction effects? Do they provide any evidence that BIC schools were on a different trajectory prior to 2010? (**5 points**)

See attached log. The coefficients on the *bic2010* x *year* interactions show how the gap in breakfast participation between BIC and non-BIC schools changed in each year, relative to the omitted year (2009). The leading coefficients (2005-2008) are all around -0.05 to -0.06 and are statistically different from zero. There is no obvious trend in these coefficients, with the exception of the "tick up" in 2009. This suggests the two groups of schools were on parallel trends leading up to 2009. It is possible that there is mis-measurement in the data (i.e., some schools adopted BIC in 2009 but are coded as 2010) The command `coefplot` is one way to display the event study coefficients—see log.

(j) Repeat part (i) but use the `eventdd` command described in class to obtain the event study regression results and graph. (You may have to install this using `ssc install eventdd`). This command also requires installation of another user-written command called `matsort`. (**5 points**).

See attached log.

(k) Some schools adopted BIC in years other than 2010. (Do a crosstabulation of *year* and *bicpost* to see this). Using the full dataset (school types 1-3), re-estimate your difference-in-differences model with school fixed effects (as in part h) and include a $BIC \times post$ interaction for BIC schools in years following their adoption. This *bicpost* variable has already been created for you. Try the models without and with covariates, and include year effects since the "post" period varies by school. How do your results compare to the earlier ones? (**5 points**)

See attached log. The difference-in-differences estimate of 24 percentage points is quite comparable to the earlier ones.

(l) Repeat the event study regression and graph for the full sample used in part (j), using `eventdd`. (**5 points**)

See attached log.

Question 2. For these questions, refer to the recent article by Cellini and Turner (2019), "Gainfully Employed? Assessing the Employment and Earnings of For-Profit College Students Using Administrative Data." You can find the article here: `http://jhr.uwpress.org/content/54/2/342.abstract`. **(37 points)**

(a) Cellini and Turner use a generalized difference-in-differences regression model to estimate the causal effect of attending a for-profit certificate program on labor market outcomes. What specific outcome variables do they examine, and what dataset(s) do they use? **(4 points)**

The main outcome variables include employment (0/1) and earnings (levels and logs). US DOE data identify all federally-aided students who exited a for-profit post-secondary institution or public community college certificate program between 2006 and 2008. Income and employment status are taken from tax data from the IRS (1999-2014).

(b) How is the "treatment" variable defined here and what are the possible "pre" and "post" years? How many potential pre and post years are there? **(4 points)**

"Treatment" is attendance at a for-profit post-secondary institution. The potential "pre-treatment" years are 1999-2007, depending on when students started and exited their program. The potential "post" years are 2007-2014, again depending on when students left their program. Thus, there are approximately 6 pre-treatment years and 5-6 post-treatment years available.

(c) The authors use three different groups of "untreated" individuals as comparison groups. What were they, and what was their rationale for looking at each? Which comparison group is their "preferred" one, and why? **(4 points)**

Their comparison groups include: (1) public community college students; (2) public community college students matched by demographics, prior earnings, field of study, geography, and age group; and (3) a matched sample of individuals with no post-secondary education. The first two comparison groups are used to estimate the effect of attending a for-profit institution relative to a public institution. The second is preferred by the authors since it accounts for differences in the composition of these two populations (for-profit and public). The third comparison group is used to estimate the

effect of attending a for-profit institution relative to no college. One challenge with the "no college" comparison group is the lack of a defined pre- and post- period. Unlike the community college comparison group, the no college group also cannot be matched based on, say, field of study.

(d) Equation (1) on page 350 shows their regression specification. Carefully explain what each term represents, and how the causal effect of attending a for-profit certificate program is being identified. Why is there not a main effect for "For-Profit" in the model? **(5 points)**

$$y_{it} = \alpha_0 + \alpha_1(Post_{it}) + \alpha_2(Post_{it} * ForProfit_i) + d_t + d_a + d_i + \epsilon_i t$$

- $Post_{it} = 1$ **in all years following exit from the post-secondary program**
- $ForProfit_i = 1$ **for individuals** i **that attended a for-profit program**
- d_t **are year effects to capture mean differences in the outcome due to macroeconomic conditions**
- d_a **are age fixed effects to capture mean differences in the outcome due to, say, work experience**
- d_i **are individual fixed effects**
- α_1 **is the "first difference": the mean pre-to-post change in the outcome for individuals who attended public certificate programs**
- α_2 **is the "second difference" (or DD): the differential pre-to-post change in the outcome for individuals who attended a for-profit program**

There are individual fixed effects in this regression, which means coefficient estimates are identified using *within-person* changes over time. There is no $ForProfit_i$ **main effect since it is collinear with the individual effect. (It does not vary over time, but rather just indicates whether or not the student ultimately enrolled in a for-profit institution).**

(e) Carefully explain the main assumption necessary to interpret the difference-in-differences estimate here as a causal effect. What evidence do the authors provide that this assumption holds for their three different comparison groups? **(5 points)**

The assumption is that the pre-to-post change in the outcome for the comparison group (e.g., public college attendees) represents what would have occurred for the treatment group (for-profit attendees), had they not been treated. Figure 1 displays the trend in employment and earnings for each group, prior to their enrollment in a post-secondary program. While there are differences in the levels of earnings and employment, the time trends look very similar. This is particularly true for the matched sample. This provides some confidence that the trends would have remained the same in the absence of the treatment.

(f) The paper's main results are reported in Table 3. Carefully interpret the coefficients reported in Panel B. What additional evidence does Figure 2 provide? **(10 points)**

Panel B of Table 3 reports the estimated pre-post change for the matched public sample, and the DD. For individuals who enrolled in public community college programs, annual earnings increased by $1,069, on average, in years after exit from the program. For individuals in for-profit programs, this change was $2,144 *lower*. Taken together, the annual earnings of the treatment group *declined* by an average of $1,075.

The log earnings column excludes individuals with zero earnings, and thus should be interpreted as conditional on working. For individuals in public community college programs, annual earnings increased by about 16.8%. For individuals in for-profit programs, this change was 11.3 percentage points *lower*. Taken together, their annual earnings—conditional on working—increased by 5.5%.

The first column shows the effect on employment. For individuals in public programs, there was no significant change in the probability of employment. However, for individuals in for-profit programs, the probability of employment *declined* by 1.5 percentage points after exiting their program.

Figure 2 is an event study—it shows the differential effect of attending a for-profit program separately for each year after exiting the program.

(g) Finally, Figure 4 shows the distribution of earnings effects *by school* for public and for-profit institutions. Cellini and Turner describe these as the result of "single-difference" regressions. Briefly explain what they mean by this, and why these should not be interpreted as the causal effects of attending specific institutions. **(5 points)**

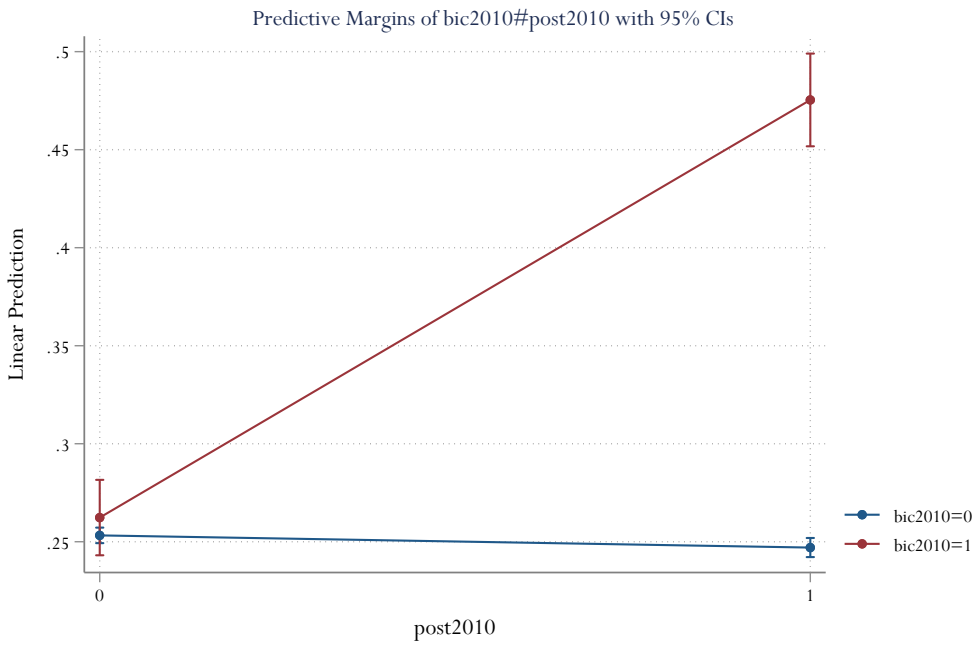
It would be difficult to estimate a separate difference-in-differences model for each school since it is not obvious who the comparison group should be. (I.e., who are the students exiting public programs that might have attended *that specific for-profit program*?) Instead, Cellini & Turner estimate mean within-person, pre-post changes in earnings for each for-profit institution. These are single differences because they represent only the mean pre-post change of one group. As with any single difference, they should not be interpreted as causal, as it is difficult to separate the treatment effect from any change in the outcome over time that might have occurred in the absence of the treatment.

```
.
. // ************************************************************************
. // LPO-8852 Problem set 3 solutions
. // Last updated: September 29, 2021
. // ************************************************************************
.
. // ****
. // (a)
. // ****
. // Get data
. use https://github.com/spcorcor18/LPO-8852/raw/main/data/NYCbkfastlunch.dta, clear
. summ bkfast_part lunch_part
    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
 bkfast_part |      8,061    .2594672    .1446061   .0054945   .9759036
  lunch_part |      7,790    .7767745    .1836831   .0122249          1
.
.
. // ****
. // (b)
. // ****
. // Set panel
. xtset schoolid year
       panel variable:  schoolid (unbalanced)
        time variable:  year, 2005 to 2012, but with gaps
                delta:  1 unit
. xtdescribe
schoolid:  1, 2, ..., 1179                                  n =       1134
    year:  2005, 2006, ..., 2012                            T =          8
           Delta(year) = 1 unit
           Span(year)  = 8 periods
           (schoolid*year uniquely identifies each observation)
Distribution of T_i:   min      5%     25%       50%       75%     95%     max
                         1       2       8         8         8       8       8
     Freq.  Percent    Cum. |  Pattern
 ---------------------------+----------
      908     80.07   80.07 |  11111111
       66      5.82   85.89 |  ......11
       31      2.73   88.62 |  .....111
       29      2.56   91.18 |  ....1111
       17      1.50   92.68 |  .1111111
       16      1.41   94.09 |  ...11111
       14      1.23   95.33 |  .......1
       10      0.88   96.21 |  ..111111
        9      0.79   97.00 |  1111....
       34      3.00  100.00 | (other patterns)
 ---------------------------+----------
     1134    100.00         |  XXXXXXXX
.
.
. // ****
. // (c)
. // ****
. // Simple DD for limited sample (those who adopt BIC in 2010, or not at all)
```

```
. tabulate year bic2010
           | =1 if school adopted
           |      BIC in 2010
      year |         0          1 |     Total
-----------+----------------------+----------
      2005 |       915         30 |       945
      2006 |       934         30 |       964
      2007 |       938         30 |       968
      2008 |       949         30 |       979
      2009 |       971         30 |     1,001
      2010 |       995         33 |     1,028
      2011 |     1,057         33 |     1,090
      2012 |     1,061         33 |     1,094
-----------+----------------------+----------
     Total |     7,820        249 |     8,069
. gen byte ansample=0
. replace  ansample=1 if bic2010==1 | bicever==0
(6,167 real changes made)
.
. gen     post2010=(year>=2010 & year~=.)
.
. _eststo bk1: reg bkfast_part i.bic2010##i.post2010 if ansample
      Source |       SS           df       MS      Number of obs   =     6,160
-------------+----------------------------------   F(3, 6156)      =    122.75
       Model |  6.66627777         3  2.22209259   Prob > F        =    0.0000
    Residual |  111.439598     6,156  .018102599   R-squared       =    0.0564
-------------+----------------------------------   Adj R-squared   =    0.0560
       Total |  118.105875     6,159  .019176145   Root MSE        =    .13455
------------------------------------------------------------------------------
 bkfast_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   1.bic2010 |   .0364431    .011215     3.25   0.001     .0144578    .0584285
  1.post2010 |   .0004512   .0035743     0.13   0.900    -.0065557    .0074581
             |
     bic2010#|
    post2010 |
        1 1  |   .2219777   .0177852    12.48   0.000     .1871125     .256843
             |
       _cons |   .2494476   .0022566   110.54   0.000     .2450239    .2538713
------------------------------------------------------------------------------
```

```
. _eststo lu1: reg lunch_part i.bic2010##i.post2010 if ansample
      Source |       SS           df       MS      Number of obs   =     5,971
-------------+----------------------------------   F(3, 5967)      =     12.18
       Model |  1.27574115         3  .425247049   Prob > F        =    0.0000
    Residual |  208.309617     5,967  .034910276   R-squared       =    0.0061
-------------+----------------------------------   Adj R-squared   =    0.0056
       Total |  209.585358     5,970  .035106425   Root MSE        =    .18684
------------------------------------------------------------------------------
  lunch_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   1.bic2010 |   .0698994   .0163374     4.28   0.000     .0378722    .1019265
  1.post2010 |  -.0118983   .0050251    -2.37   0.018    -.0217493   -.0020474
             |
     bic2010#|
    post2010 |
        1 1  |  -.0012284   .0254085    -0.05   0.961    -.0510383    .0485815
             |
       _cons |   .7724005   .0031963   241.65   0.000     .7661345    .7786665
------------------------------------------------------------------------------
.
.
. // ****
. // (d)
. // ****
. // Descriptive statistics for BIC 2010 adopters and those who never adopt BIC
. sum totalenrollment- pctfemale free1 redu1 if ansample & bic2010==0, sep(0)
    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
totalenrol~t |      5,918    659.1048    338.0388          1       2324
      pctell |      5,917    13.08352    11.82031          0       98.8
     pctsped |      5,918    15.01414    6.168555          0        100
    pctasian |      5,918    13.47043    18.23617          0       93.3
    pctblack |      5,918     31.8549    29.64572          0        100
     pcthisp |      5,918    38.16107    25.82034          0        100
    pctwhite |      5,918    15.56301    21.71753          0        100
   pctfemale |      5,918     49.2623    5.328382          0        100
       free1 |      5,916    68.71993     23.0606   3.787879        100
       redu1 |      5,916    9.868489    5.385444          0   75.33414
. sum totalenrollment- pctfemale free1 redu1 if ansample & bic2010==1, sep(0)
    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
totalenrol~t |        249    639.4659     269.285        155       1344
      pctell |        249    14.66145    10.83286         .5         49
     pctsped |        249    17.23976    6.466239        5.7       38.3
    pctasian |        249     3.01245    5.150388          0       24.5
    pctblack |        249    45.78554    28.32688        1.5       96.4
     pcthisp |        249     45.8494    26.93749        2.6       92.1
    pctwhite |        249    4.431727    11.69414          0       68.8
   pctfemale |        249    48.77711    2.737346         41       55.7
       free1 |        249    83.92061    12.21668   33.04158        100
       redu1 |        249    7.111174    3.788053          0    15.5102
.
.
. // ****
. // (e)
. // ****
. // Simple DD with covariates
. global covars "pctell pctsped totalenrollment pctasian pctblack pcthisp"
```

```
. global covars "$covars pctfemale free1 redu1"
.
. _eststo bk2: reg bkfast_part i.bic2010##i.post2010 $covars if ansample
      Source |       SS           df       MS      Number of obs   =     6,159
-------------+----------------------------------   F(12, 6146)     =    180.70
       Model |  30.8011322        12  2.56676102   Prob > F        =    0.0000
    Residual |  87.3017665     6,146  .014204648   R-squared       =    0.2608
-------------+----------------------------------   Adj R-squared   =    0.2594
       Total |  118.102899     6,158  .019178775   Root MSE        =    .11918
------------------------------------------------------------------------------
  bkfast_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    1.bic2010 |   .0090898   .0100252     0.91   0.365    -.0105631    .0287428
   1.post2010 |  -.0061984   .0032369    -1.91   0.056     -.012544    .0001471
              |
      bic2010#|
     post2010 |
         1 1  |   .2192397   .0157598    13.91   0.000     .1883451    .2501344
              |
       pctell |   .0009818   .0001984     4.95   0.000     .0005929    .0013707
      pctsped |   .0008707    .000289     3.01   0.003     .0003041    .0014373
totalenroll~t |  -.0001309   4.92e-06   -26.63   0.000    -.0001405   -.0001213
     pctasian |  -.0004099   .0001441    -2.84   0.004    -.0006923   -.0001274
     pctblack |  -.0001128   .0001124    -1.00   0.316    -.0003332    .0001076
      pcthisp |  -.0008151   .0001285    -6.35   0.000    -.0010669   -.0005633
    pctfemale |  -.0018614   .0003124    -5.96   0.000    -.0024739   -.0012489
        free1 |   .0019951     .00012    16.63   0.000     .0017598    .0022303
        redu1 |   .0019409   .0003249     5.97   0.000      .001304    .0025778
        _cons |   .2881719   .0194463    14.82   0.000     .2500504    .3262935
------------------------------------------------------------------------------
. margins bic2010#post2010
Predictive margins                              Number of obs     =      6,159
Model VCE    : OLS
Expression   : Linear prediction, predict()
------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     bic2010#|
    post2010 |
        0 0  |   .2532383   .0020199   125.37   0.000     .2492785    .2571981
        0 1  |   .2470399   .0024864    99.36   0.000     .2421657    .2519141
        1 0  |   .2623282   .0098097    26.74   0.000     .2430977    .2815586
        1 1  |   .4753695   .0120615    39.41   0.000     .4517247    .4990143
------------------------------------------------------------------------------
. marginsplot, xdim(post2010)  name(parte,replace)
  Variables that uniquely identify margins: bic2010 post2010
. graph export parte.pdf, name(parte) as(pdf) replace
(file parte.pdf written in PDF format)
```




```
.
. _eststo lu2: reg lunch_part i.bic2010##i.post2010 $covars if ansample
      Source |       SS           df       MS      Number of obs   =     5,970
-------------+----------------------------------   F(12, 5957)     =    471.98
       Model |  102.139697        12  8.51164141   Prob > F        =    0.0000
    Residual |  107.427693     5,957  .018033858   R-squared       =    0.4874
-------------+----------------------------------   Adj R-squared   =    0.4864
       Total |   209.56739     5,969  .035109296   Root MSE        =    .13429
------------------------------------------------------------------------------
   lunch_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    1.bic2010 |    .000049   .0118444     0.00   0.997    -.0231703    .0232682
   1.post2010 |  -.0132425   .0036987    -3.58   0.000    -.0204932   -.0059918
              |
      bic2010#|
     post2010 |
        1 1   |   .0055167   .0182669     0.30   0.763     -.030293    .0413265
              |
       pctell |   .0020897   .0002269     9.21   0.000     .0016449    .0025345
      pctsped |  -.0001192   .0003317    -0.36   0.719    -.0007696    .0005311
totalenroll~t |  -.0000249   5.59e-06    -4.45   0.000    -.0000358   -.0000139
     pctasian |   .0010351   .0001629     6.35   0.000     .0007157    .0013546
     pctblack |   .0004639   .0001276     3.64   0.000     .0002137     .000714
      pcthisp |   .0004775   .0001461     3.27   0.001     .0001911     .000764
    pctfemale |  -.0029157    .000354    -8.24   0.000    -.0036097   -.0022217
        free1 |   .0050856   .0001371    37.10   0.000      .004817    .0053543
        redu1 |   .0056645   .0003697    15.32   0.000     .0049398    .0063893
        _cons |    .457841   .0220444    20.77   0.000      .414626     .501056
------------------------------------------------------------------------------
.
.
. // ****
. // (f)
. // ****
. // Simple DD with linear time trend
```

```
. gen time=year-2010
. label var time "linear time trend (0 = 2010)"
.
. _eststo bk3: reg bkfast_part i.bic2010##i.post2010 time if ansample
      Source |       SS           df       MS      Number of obs   =     6,160
-------------+----------------------------------   F(4, 6155)      =     98.51
       Model |  7.10607017         4  1.77651754   Prob > F        =    0.0000
    Residual |  110.999805     6,155  .018034087   R-squared       =    0.0602
-------------+----------------------------------   Adj R-squared   =    0.0596
       Total |  118.105875     6,159  .019176145   Root MSE        =    .13429
------------------------------------------------------------------------------
 bkfast_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   1.bic2010 |   .0366001   .0111938     3.27   0.001     .0146563    .0585438
  1.post2010 |  -.0274635   .0066844    -4.11   0.000    -.0405672   -.0143599
             |
     bic2010#|
    post2010 |
        1 1  |   .2219954   .0177515    12.51   0.000     .1871962    .2567947
             |
        time |   .0069743   .0014123     4.94   0.000     .0042057    .0097428
       _cons |   .2702134   .0047703    56.65   0.000      .260862    .2795648
------------------------------------------------------------------------------
. _eststo lu3: reg lunch_part i.bic2010##i.post2010 time if ansample
      Source |       SS           df       MS      Number of obs   =     5,971
-------------+----------------------------------   F(4, 5966)      =      9.24
       Model |  1.29011709         4  .322529273   Prob > F        =    0.0000
    Residual |  208.295241     5,966  .034913718   R-squared       =    0.0062
-------------+----------------------------------   Adj R-squared   =    0.0055
       Total |  209.585358     5,970  .035106425   Root MSE        =    .18685
------------------------------------------------------------------------------
  lunch_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   1.bic2010 |   .0699698   .0163385     4.28   0.000     .0379403    .1019992
  1.post2010 |  -.0170725   .0095012    -1.80   0.072    -.0356983    .0015533
             |
     bic2010#|
    post2010 |
        1 1  |  -.0012979     .02541    -0.05   0.959    -.0511107    .0485149
             |
        time |   .0012876   .0020067     0.64   0.521    -.0026462    .0052214
       _cons |   .7762593   .0068103   113.98   0.000     .7629086      .78961
------------------------------------------------------------------------------
.
```

```
. _eststo bk4: reg bkfast_part i.bic2010##i.post2010 $covars time if ansample
      Source |       SS           df       MS      Number of obs   =     6,159
-------------+----------------------------------   F(13, 6145)     =    169.08
       Model |  31.1152371        13  2.39347978   Prob > F        =    0.0000
    Residual |  86.9876616     6,145  .014155844   R-squared       =    0.2635
-------------+----------------------------------   Adj R-squared   =    0.2619
       Total |  118.102899     6,158  .019178775   Root MSE        =    .11898
------------------------------------------------------------------------------
  bkfast_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    1.bic2010 |   .0092302    .010008     0.92   0.356     -.010389    .0288494
   1.post2010 |  -.0296849   .0059415    -5.00   0.000    -.0413323   -.0180375
              |
      bic2010#|
     post2010 |
        1 1   |   .2193495   .0157327    13.94   0.000     .1885079    .2501911
              |
       pctell |   .0009559   .0001981     4.82   0.000     .0005675    .0013443
      pctsped |   .0007479   .0002897     2.58   0.010        .00018    .0013159
totalenroll~t |  -.0001299   4.91e-06   -26.44   0.000    -.0001395   -.0001202
     pctasian |  -.0004453    .000144    -3.09   0.002    -.0007276   -.0001629
     pctblack |  -.0001327   .0001123    -1.18   0.237    -.0003529    .0000874
      pcthisp |  -.0008354   .0001283    -6.51   0.000    -.0010869   -.0005839
    pctfemale |  -.0018919    .000312    -6.06   0.000    -.0025035   -.0012804
        free1 |   .0020306     .00012    16.92   0.000     .0017953    .0022659
        redu1 |   .0020122   .0003247     6.20   0.000     .0013758    .0026487
         time |   .0059491   .0012629     4.71   0.000     .0034733    .0084249
        _cons |   .3075019   .0198418    15.50   0.000     .2686049    .3463988
------------------------------------------------------------------------------
```

```
. _eststo lu4: reg lunch_part i.bic2010##i.post2010 $covars time if ansample
      Source |       SS           df       MS      Number of obs   =     5,970
-------------+----------------------------------   F(13, 5956)     =    437.59
       Model |  102.378673        13  7.87528254   Prob > F        =    0.0000
    Residual |  107.188716     5,956  .017996762   R-squared       =    0.4885
-------------+----------------------------------   Adj R-squared   =    0.4874
       Total |   209.56739     5,969  .035109296   Root MSE        =    .13415
------------------------------------------------------------------------------
   lunch_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    1.bic2010 |   .0003089   .0118324     0.03   0.979    -.0228869    .0235047
   1.post2010 |  -.0342506   .0068475    -5.00   0.000    -.0476741    -.020827
              |
      bic2010#|
     post2010 |
         1 1  |   .0053054   .0182482     0.29   0.771    -.0304677    .0410785
              |
       pctell |   .0020656   .0002268     9.11   0.000     .0016211    .0025101
      pctsped |  -.0002263   .0003327    -0.68   0.496    -.0008785    .0004259
totalenroll~t |  -.0000241   5.59e-06    -4.30   0.000     -.000035   -.0000131
     pctasian |   .0010026    .000163     6.15   0.000      .000683    .0013222
     pctblack |   .0004451   .0001276     3.49   0.000      .000195    .0006951
      pcthisp |   .0004586   .0001461     3.14   0.002     .0001722    .0007449
    pctfemale |  -.0029416   .0003537    -8.32   0.000     -.003635   -.0022481
        free1 |   .0051204   .0001373    37.31   0.000     .0048513    .0053895
        redu1 |   .0057274   .0003697    15.49   0.000     .0050026    .0064522
         time |   .0052989   .0014541     3.64   0.000     .0024482    .0081495
        _cons |   .4750103   .0225201    21.09   0.000     .4308627    .5191579
------------------------------------------------------------------------------
.
.
. // ****
. // (g)
. // ****
. // Simple DD with year effects
```

```
. _eststo bk5: reg bkfast_part i.bic2010##i.post2010 i.year if ansample
note: 2012.year omitted because of collinearity
      Source |       SS           df       MS      Number of obs   =     6,160
-------------+----------------------------------   F(9, 6150)      =     46.07
       Model |  7.45976317         9  .828862574   Prob > F        =    0.0000
    Residual |  110.646112     6,150  .017991238   R-squared       =    0.0632
-------------+----------------------------------   Adj R-squared   =    0.0618
       Total |  118.105875     6,159  .019176145   Root MSE        =    .13413
------------------------------------------------------------------------------
 bkfast_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   1.bic2010 |    .036649   .0111805     3.28   0.001     .0147313    .0585667
  1.post2010 |    .013186   .0068367     1.93   0.054    -.0002162    .0265883
             |
     bic2010#|
    post2010 |
        1 1  |    .221605   .0177307    12.50   0.000     .1868466    .2563634
             |
        year |
        2006 |   .0016656   .0070186     0.24   0.812    -.0120932    .0154245
        2007 |   .0129012   .0070115     1.84   0.066    -.0008438    .0266462
        2008 |   .0302031   .0069998     4.31   0.000      .016481    .0439252
        2009 |   .0337616   .0069611     4.85   0.000     .0201153    .0474079
        2010 |   .0103849   .0066675     1.56   0.119    -.0026858    .0234556
        2011 |  -.0003521   .0065567    -0.05   0.957    -.0132056    .0125013
        2012 |          0  (omitted)
             |
       _cons |   .2335355    .005003    46.68   0.000     .2237279     .243343
------------------------------------------------------------------------------
```

```
. _eststo lu5: reg lunch_part i.bic2010##i.post2010 i.year if ansample
note: 2012.year omitted because of collinearity
      Source |       SS           df       MS      Number of obs   =     5,971
-------------+----------------------------------   F(9, 5961)      =      5.29
       Model |  1.66017991         9  .184464435   Prob > F        =    0.0000
    Residual |  207.925179     5,961  .034880922   R-squared       =    0.0079
-------------+----------------------------------   Adj R-squared   =    0.0064
       Total |  209.585358     5,970  .035106425   Root MSE        =    .18676
------------------------------------------------------------------------------
  lunch_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   1.bic2010 |   .0700814   .0163311     4.29   0.000     .0380665    .1020963
  1.post2010 |  -.0131431   .0096473    -1.36   0.173    -.0320552     .005769
             |
     bic2010#|
    post2010 |
        1 1  |  -.0014192   .0253983    -0.06   0.955     -.051209    .0483706
             |
        year |
        2006 |   .0061342   .0099098     0.62   0.536    -.0132927    .0255611
        2007 |   .0130161   .0099166     1.31   0.189    -.0064241    .0324563
        2008 |   .0177306   .0099723     1.78   0.075    -.0018188      .03728
        2009 |   .0157621   .0099376     1.59   0.113    -.0037192    .0352433
        2010 |   .0241326    .009349     2.58   0.010     .0058052    .0424601
        2011 |   .0120087   .0092097     1.30   0.192    -.0060456     .030063
        2012 |          0  (omitted)
             |
       _cons |   .7618583   .0070841   107.54   0.000     .7479709    .7757457
------------------------------------------------------------------------------
.
```

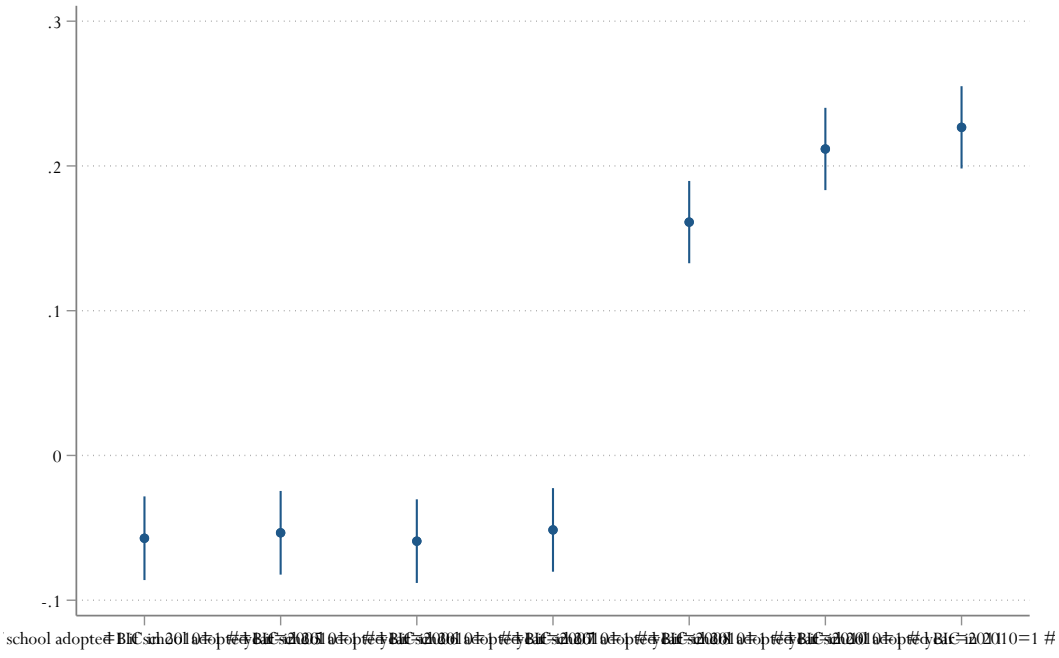
```
. _eststo bk6: reg bkfast_part i.bic2010##i.post2010 $covars i.year if ansample
note: 2012.year omitted because of collinearity
      Source |       SS           df       MS      Number of obs   =     6,159
-------------+----------------------------------   F(18, 6140)     =    123.66
       Model |  31.4223181        18  1.74568434   Prob > F        =    0.0000
    Residual |  86.6805806     6,140  .014117358   R-squared       =    0.2661
-------------+----------------------------------   Adj R-squared   =    0.2639
       Total |  118.102899     6,158  .019178775   Root MSE        =    .11882
------------------------------------------------------------------------------
  bkfast_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    1.bic2010 |   .0092247   .0099945     0.92   0.356    -.0103679    .0288174
   1.post2010 |   .0046158   .0061274     0.75   0.451     -.007396    .0166276
              |
      bic2010#|
     post2010 |
         1 1  |   .2191936   .0157114    13.95   0.000     .1883938    .2499934
              |
       pctell |   .0008866   .0001989     4.46   0.000     .0004967    .0012764
      pctsped |   .0005844   .0002916     2.00   0.045     .0000128     .001156
totalenroll~t |  -.0001301   4.91e-06   -26.51   0.000    -.0001397   -.0001205
     pctasian |  -.0004491   .0001439    -3.12   0.002    -.0007311   -.0001671
     pctblack |  -.0001452   .0001122    -1.29   0.196    -.0003652    .0000748
      pcthisp |  -.0008295   .0001281    -6.47   0.000    -.0010807   -.0005783
    pctfemale |  -.0019468   .0003118    -6.24   0.000     -.002558   -.0013356
        free1 |    .002053     .00012    17.10   0.000     .0018177    .0022884
        redu1 |   .0019546   .0003248     6.02   0.000      .001318    .0025913
              |
         year |
        2006  |   .0002767   .0062238     0.04   0.965    -.0119242    .0124777
        2007  |   .0100518   .0062234     1.62   0.106    -.0021483    .0222519
        2008  |   .0253551   .0062545     4.05   0.000     .0130941     .037616
        2009  |   .0296896   .0062229     4.77   0.000     .0174905    .0418887
        2010  |   .0105032   .0059306     1.77   0.077    -.0011229    .0221294
        2011  |  -.0013092   .0058115    -0.23   0.822    -.0127017    .0100834
        2012  |          0  (omitted)
              |
        _cons |   .2819381   .0197941    14.24   0.000     .2431347    .3207415
------------------------------------------------------------------------------
```

```
. _eststo lu6: reg lunch_part i.bic2010##i.post2010 $covars i.year if ansample
note: 2012.year omitted because of collinearity
      Source |       SS           df       MS      Number of obs   =     5,970
-------------+----------------------------------   F(18, 5951)     =    318.88
       Model |  102.890378        18  5.71613213   Prob > F        =    0.0000
    Residual |  106.677011     5,951  .017925897   R-squared       =    0.4910
-------------+----------------------------------   Adj R-squared   =    0.4894
       Total |   209.56739     5,969  .035109296   Root MSE        =    .13389
------------------------------------------------------------------------------
   lunch_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    1.bic2010 |   .0003312   .0118093     0.03   0.978    -.0228194    .0234817
   1.post2010 |  -.0029389    .007001    -0.42   0.675    -.0166634    .0107856
              |
      bic2010#|
     post2010 |
         1 1  |   .0053633   .0182124     0.29   0.768    -.0303395    .0410662
              |
       pctell |   .0019851   .0002275     8.73   0.000     .0015391     .002431
      pctsped |  -.0004065   .0003345    -1.22   0.224    -.0010622    .0002492
totalenroll~t |   -.000024   5.58e-06    -4.30   0.000    -.0000349    -.000013
     pctasian |   .0009978   .0001627     6.13   0.000     .0006788    .0013168
     pctblack |    .000428   .0001274     3.36   0.001     .0001782    .0006777
      pcthisp |   .0004604   .0001458     3.16   0.002     .0001746    .0007462
    pctfemale |  -.0029913   .0003533    -8.47   0.000    -.0036839   -.0022987
        free1 |   .0051531   .0001372    37.56   0.000     .0048841     .005422
        redu1 |   .0056432   .0003696    15.27   0.000     .0049186    .0063679
              |
         year |
        2006  |   .0124052   .0071109     1.74   0.081    -.0015347    .0263452
        2007  |   .0230456   .0071232     3.24   0.001     .0090816    .0370095
        2008  |   .0307087   .0072128     4.26   0.000      .016569    .0448484
        2009  |   .0359396   .0071874     5.00   0.000     .0218497    .0500295
        2010  |   .0213247    .006728     3.17   0.002     .0081355    .0345139
        2011  |   .0110212   .0066061     1.67   0.095    -.0019292    .0239717
        2012  |          0  (omitted)
              |
        _cons |   .4439037   .0224522    19.77   0.000     .3998892    .4879182
------------------------------------------------------------------------------
.
.
. // ****
. // (h)
. // ****
. // Two-way fixed effects model
```

```
. _eststo bk7: xtreg bkfast_part i.bic2010##i.post2010 i.year $covars  if ansample, fe
note: 1.bic2010 omitted because of collinearity
note: 2012.year omitted because of collinearity
Fixed-effects (within) regression               Number of obs     =      6,159
Group variable: schoolid                        Number of groups  =        877
R-sq:                                           Obs per group:
     within  = 0.2282                                         min =          1
     between = 0.1835                                         avg =        7.0
     overall = 0.2257                                         max =          8
                                                F(17,5265)        =      91.56
corr(u_i, Xb)  = 0.1285                         Prob > F          =     0.0000
------------------------------------------------------------------------------
  bkfast_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    1.bic2010 |          0  (omitted)
   1.post2010 |    .008418   .0032356     2.60   0.009     .0020748    .0147612
              |
      bic2010#|
     post2010 |
         1 1  |   .2439241   .0076516    31.88   0.000     .2289237    .2589244
              |
         year |
         2006 |   .0015795   .0029676     0.53   0.595    -.0042382    .0073972
         2007 |   .0103671    .003006     3.45   0.001     .0044741    .0162602
         2008 |    .027108   .0031138     8.71   0.000     .0210036    .0332123
         2009 |   .0308461   .0031798     9.70   0.000     .0246124    .0370798
         2010 |   .0103183   .0028919     3.57   0.000     .0046491    .0159876
         2011 |  -.0000499   .0027699    -0.02   0.986    -.0054799    .0053802
         2012 |          0  (omitted)
              |
       pctell |   .0003947   .0003068     1.29   0.198    -.0002068    .0009962
      pctsped |   -.000535   .0003514    -1.52   0.128    -.0012239     .000154
totalenroll~t |  -.0001048   8.90e-06   -11.78   0.000    -.0001222   -.0000874
     pctasian |   .0003682   .0004336     0.85   0.396    -.0004818    .0012183
     pctblack |   .0003755   .0003397     1.11   0.269    -.0002905    .0010415
      pcthisp |   .0000632   .0003393     0.19   0.852     -.000602    .0007283
    pctfemale |  -.0004462   .0003711    -1.20   0.229    -.0011738    .0002814
        free1 |   .0005912   .0001113     5.31   0.000     .0003731    .0008093
        redu1 |   .0008902   .0002559     3.48   0.001     .0003885    .0013919
        _cons |    .262379   .0327649     8.01   0.000     .1981461    .3266118
--------------+---------------------------------------------------------------
      sigma_u |   .1222614
      sigma_e |  .05605524
          rho |  .82630276   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(876, 5265) = 25.49                     Prob > F = 0.0000
```

```
. _eststo lu7: xtreg lunch_part i.bic2010##i.post2010 i.year $covars  if ansample, fe
note: 1.bic2010 omitted because of collinearity
note: 2012.year omitted because of collinearity
Fixed-effects (within) regression               Number of obs     =      5,970
Group variable: schoolid                        Number of groups  =        876
R-sq:                                           Obs per group:
     within  = 0.0985                                         min =          1
     between = 0.2635                                         avg =        6.8
     overall = 0.2706                                         max =          8
                                                F(17,5077)        =      32.62
corr(u_i, Xb)  = -0.0497                        Prob > F          =     0.0000
------------------------------------------------------------------------------
   lunch_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    1.bic2010 |          0  (omitted)
   1.post2010 |   .0001747   .0037997     0.05   0.963    -.0072743    .0076237
              |
      bic2010#|
     post2010 |
         1 1  |   .0033581   .0091823     0.37   0.715    -.0146431    .0213593
              |
         year |
        2006  |   .0092449   .0034715     2.66   0.008     .0024391    .0160506
        2007  |   .0181451   .0035263     5.15   0.000     .0112321    .0250582
        2008  |   .0271614   .0036868     7.37   0.000     .0199337    .0343892
        2009  |   .0312953   .0037637     8.32   0.000     .0239169    .0386737
        2010  |   .0179463    .003362     5.34   0.000     .0113554    .0245371
        2011  |   .0101406   .0032232     3.15   0.002     .0038218    .0164595
        2012  |          0  (omitted)
              |
       pctell |   .0000564   .0003633     0.16   0.877    -.0006558    .0007685
      pctsped |  -.0005706   .0004137    -1.38   0.168    -.0013817    .0002405
totalenroll~t |  -.0000618   .0000106    -5.83   0.000    -.0000825    -.000041
     pctasian |   .0035514   .0005024     7.07   0.000     .0025664    .0045363
     pctblack |   .0039734   .0003953    10.05   0.000     .0031983    .0047484
      pcthisp |   .0026529   .0003953     6.71   0.000      .001878    .0034278
    pctfemale |  -.0009508   .0004347    -2.19   0.029     -.001803   -.0000987
        free1 |    .001319   .0001307    10.09   0.000     .0010628    .0015752
        redu1 |   .0016603   .0002971     5.59   0.000     .0010778    .0022428
        _cons |   .4687328   .0381207    12.30   0.000     .3939998    .5434658
--------------+---------------------------------------------------------------
      sigma_u |    .152201
      sigma_e |  .06461257
          rho |  .84730084   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(875, 5077) = 23.40                     Prob > F = 0.0000
.
.
. // ****
. // (i)
. // ****
. // Event study using xtreg and interaction of treatment and individual years
```

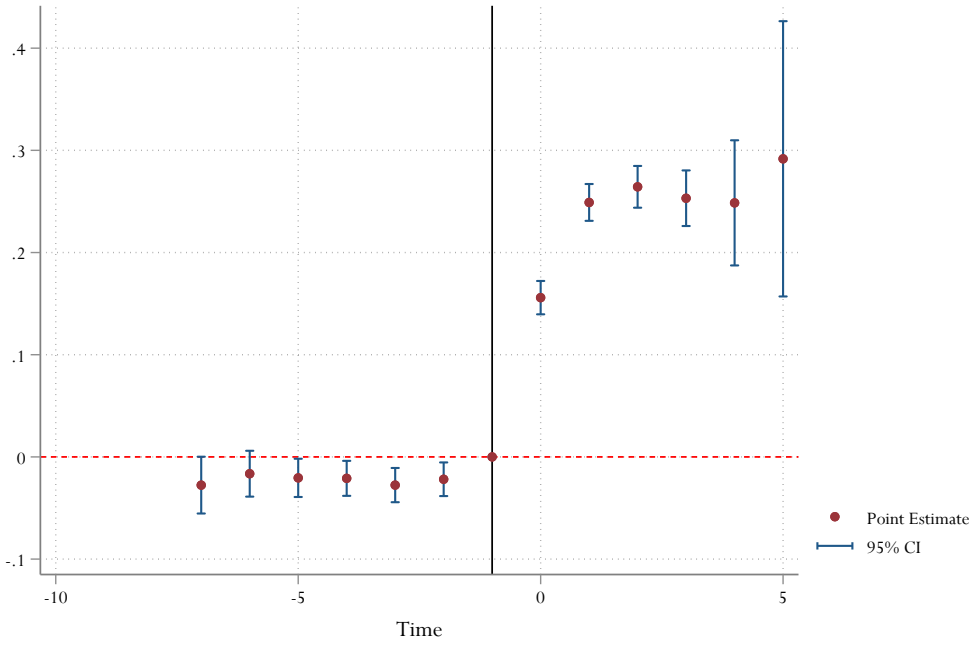
```
. _eststo bk8: xtreg bkfast_part i.bic2010##ib2009.year $covars  if ansample, fe
note: 1.bic2010 omitted because of collinearity
Fixed-effects (within) regression               Number of obs     =      6,159
Group variable: schoolid                        Number of groups  =        877
R-sq:                                           Obs per group:
     within  = 0.2350                                         min =          1
     between = 0.1827                                         avg =        7.0
     overall = 0.2220                                         max =          8
                                                F(23,5259)        =      70.23
corr(u_i, Xb)  = 0.1470                         Prob > F          =     0.0000
------------------------------------------------------------------------------
  bkfast_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    1.bic2010 |          0  (omitted)
              |
         year |
        2005  |   -.028629   .0032228    -8.88   0.000     -.034947    -.022311
        2006  |  -.0271434   .0031515    -8.61   0.000    -.0333216   -.0209651
        2007  |  -.0181234   .0030588    -5.92   0.000    -.0241199   -.0121268
        2008  |  -.0015876   .0030337    -0.52   0.601    -.0075349    .0043597
        2010  |  -.0086379   .0029975    -2.88   0.004    -.0145143   -.0027616
        2011  |  -.0211961   .0030009    -7.06   0.000    -.0270792    -.015313
        2012  |  -.0217832   .0030143    -7.23   0.000    -.0276925   -.0158739
              |
 bic2010#year |
      1 2005  |   -.057183   .0147454    -3.88   0.000    -.0860901   -.0282759
      1 2006  |  -.0534223   .0147392    -3.62   0.000    -.0823173   -.0245273
      1 2007  |  -.0591941   .0147344    -4.02   0.000    -.0880797   -.0303085
      1 2008  |  -.0514263   .0147229    -3.49   0.000    -.0802894   -.0225632
      1 2010  |   .1611984   .0144975    11.12   0.000     .1327772    .1896196
      1 2011  |   .2117195   .0144941    14.61   0.000      .183305     .240134
      1 2012  |   .2266655   .0145017    15.63   0.000     .1982361     .255095
              |
       pctell |   .0003374   .0003059     1.10   0.270    -.0002623    .0009371
      pctsped |   -.000541   .0003501    -1.55   0.122    -.0012274    .0001454
totalenroll~t |  -.0001041   8.86e-06   -11.74   0.000    -.0001215   -.0000867
     pctasian |   .0004299   .0004323     0.99   0.320    -.0004176    .0012773
     pctblack |   .0004062   .0003385     1.20   0.230    -.0002574    .0010698
      pcthisp |   .0000654    .000338     0.19   0.847    -.0005973     .000728
    pctfemale |  -.0003973   .0003702    -1.07   0.283    -.0011231    .0003285
        free1 |   .0005935   .0001109     5.35   0.000     .0003762    .0008109
        redu1 |   .0008633    .000255     3.39   0.001     .0003634    .0013632
        _cons |   .2894325   .0324408     8.92   0.000     .2258351      .35303
--------------+---------------------------------------------------------------
      sigma_u |  .12273153
      sigma_e |   .0558399
          rho |  .82849824   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(876, 5259) = 25.71                     Prob > F = 0.0000
. coefplot bk8, vertical keep(1.bic2010#*.year) name(parti)
. graph export parti.pdf, name(parti) as(pdf) replace
(file parti.pdf written in PDF format)
```


.3
.2
.1
0
-.1

.

```
. _eststo lu8: xtreg lunch_part i.bic2010##ib2009.year $covars  if ansample, fe
note: 1.bic2010 omitted because of collinearity
Fixed-effects (within) regression               Number of obs     =      5,970
Group variable: schoolid                        Number of groups  =        876
R-sq:                                           Obs per group:
     within  = 0.0989                                         min =          1
     between = 0.2636                                         avg =        6.8
     overall = 0.2707                                         max =          8
                                                F(23,5071)        =      24.20
corr(u_i, Xb)  = -0.0505                        Prob > F          =     0.0000
------------------------------------------------------------------------------
   lunch_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    1.bic2010 |          0  (omitted)
              |
         year |
        2005  |  -.0310536   .0038248    -8.12   0.000    -.0385519   -.0235553
        2006  |  -.0226167   .0037303    -6.06   0.000    -.0299296   -.0153038
        2007  |  -.0134204   .0036269    -3.70   0.000    -.0205306   -.0063102
        2008  |  -.0045999   .0036256    -1.27   0.205    -.0117076    .0025078
        2010  |  -.0133993   .0035431    -3.78   0.000    -.0203452   -.0064533
        2011  |  -.0209321   .0035575    -5.88   0.000    -.0279063   -.0139579
        2012  |  -.0315923   .0035758    -8.84   0.000    -.0386024   -.0245822
              |
 bic2010#year |
      1 2005  |  -.0054559   .0183161    -0.30   0.766    -.0413634    .0304516
      1 2006  |    .015276   .0183039     0.83   0.404    -.0206075    .0511595
      1 2007  |   .0076753   .0182209     0.42   0.674    -.0280456    .0433961
      1 2008  |   .0126151   .0183868     0.69   0.493     -.023431    .0486612
      1 2010  |   .0095776   .0179964     0.53   0.595    -.0257031    .0448584
      1 2011  |   .0028193   .0178415     0.16   0.874    -.0321578    .0377964
      1 2012  |   .0158268   .0177723     0.89   0.373    -.0190147    .0506683
              |
       pctell |   .0000579   .0003637     0.16   0.874    -.0006551    .0007708
      pctsped |  -.0005642   .0004139    -1.36   0.173    -.0013756    .0002473
totalenroll~t |  -.0000616   .0000106    -5.81   0.000    -.0000824   -.0000408
     pctasian |   .0035558   .0005029     7.07   0.000     .0025698    .0045417
     pctblack |    .003974   .0003955    10.05   0.000     .0031986    .0047495
      pcthisp |   .0026485   .0003955     6.70   0.000     .0018732    .0034238
    pctfemale |  -.0009301   .0004355    -2.14   0.033    -.0017838   -.0000764
        free1 |   .0013213   .0001308    10.10   0.000     .0010649    .0015777
        redu1 |   .0016629   .0002973     5.59   0.000       .00108    .0022458
        _cons |   .4986455   .0379023    13.16   0.000     .4243406    .5729504
--------------+---------------------------------------------------------------
      sigma_u |   .1521975
      sigma_e |  .06463478
          rho |  .84720593   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(875, 5071) = 23.38                     Prob > F = 0.0000
.
.
. // ****
. // (j)
. // ****
. // Event study using eventdd
. * ssc install eventdd
. * ssc install matsort
```

```
. gen timetoevent=year-2010 if bic2010==1
(7,820 missing values generated)
. eventdd bkfast_part $covars i.year if ansample, method(fe) timevar(timetoevent)
Fixed-effects (within) regression               Number of obs      =      6159
Group variable: schoolid                        Number of groups   =       877
R-sq:  within  = 0.2350                         Obs per group: min =         1
       between = 0.1827                                        avg =       7.0
       overall = 0.2220                                        max =         8
                                                F(23,5259)         =     70.23
corr(u_i, Xb)  = 0.1470                         Prob > F           =    0.0000
------------------------------------------------------------------------------
  bkfast_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
       pctell |   .0003374   .0003059     1.10   0.270    -.0002623    .0009371
      pctsped |   -.000541   .0003501    -1.55   0.122    -.0012274    .0001454
totalenroll~t |  -.0001041   8.86e-06   -11.74   0.000    -.0001215   -.0000867
     pctasian |   .0004299   .0004323     0.99   0.320    -.0004176    .0012773
     pctblack |   .0004062   .0003385     1.20   0.230    -.0002574    .0010698
      pcthisp |   .0000654    .000338     0.19   0.847    -.0005973     .000728
    pctfemale |  -.0003973   .0003702    -1.07   0.283    -.0011231    .0003285
        free1 |   .0005935   .0001109     5.35   0.000     .0003762    .0008109
        redu1 |   .0008633    .000255     3.39   0.001     .0003634    .0013632
              |
         year |
        2006  |   .0014856   .0030168     0.49   0.622    -.0044285    .0073997
        2007  |   .0105056    .003054     3.44   0.001     .0045186    .0164926
        2008  |   .0270414   .0031587     8.56   0.000     .0208491    .0332337
        2009  |    .028629   .0032228     8.88   0.000      .022311     .034947
        2010  |    .019991   .0032977     6.06   0.000     .0135261     .026456
        2011  |   .0074329   .0032623     2.28   0.023     .0010375    .0138282
        2012  |   .0068458   .0032615     2.10   0.036     .0004519    .0132397
              |
        lead5 |   -.057183   .0147454    -3.88   0.000    -.0860901   -.0282759
        lead4 |  -.0534223   .0147392    -3.62   0.000    -.0823173   -.0245273
        lead3 |  -.0591941   .0147344    -4.02   0.000    -.0880797   -.0303085
        lead2 |  -.0514263   .0147229    -3.49   0.000    -.0802894   -.0225632
         lag0 |   .1611984   .0144975    11.12   0.000     .1327772    .1896196
         lag1 |   .2117195   .0144941    14.61   0.000      .183305     .240134
         lag2 |   .2266655   .0145017    15.63   0.000     .1982361     .255095
        _cons |   .2608036   .0326621     7.98   0.000     .1967723    .3248349
--------------+---------------------------------------------------------------
      sigma_u |  .12273153
      sigma_e |   .0558399
          rho |  .82849824   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(876, 5259) = 25.71                     Prob > F = 0.0000
. graph export partj.pdf, replace as(pdf)
(file partj.pdf written in PDF format)
```




```
.
.
. // ****
. // (k)
. // ****
. // Two-way fixed effects model with full sample of schools (variable timing)
. tabulate year bicpost
           | =1 if post period for
           |      BIC school
      year |         0          1 |     Total
-----------+----------------------+----------
      2005 |       945          0 |       945
      2006 |       964          0 |       964
      2007 |       967          1 |       968
      2008 |       974          5 |       979
      2009 |       971         30 |     1,001
      2010 |       965         63 |     1,028
      2011 |     1,003         87 |     1,090
      2012 |       995         99 |     1,094
-----------+----------------------+----------
     Total |     7,784        285 |     8,069
```

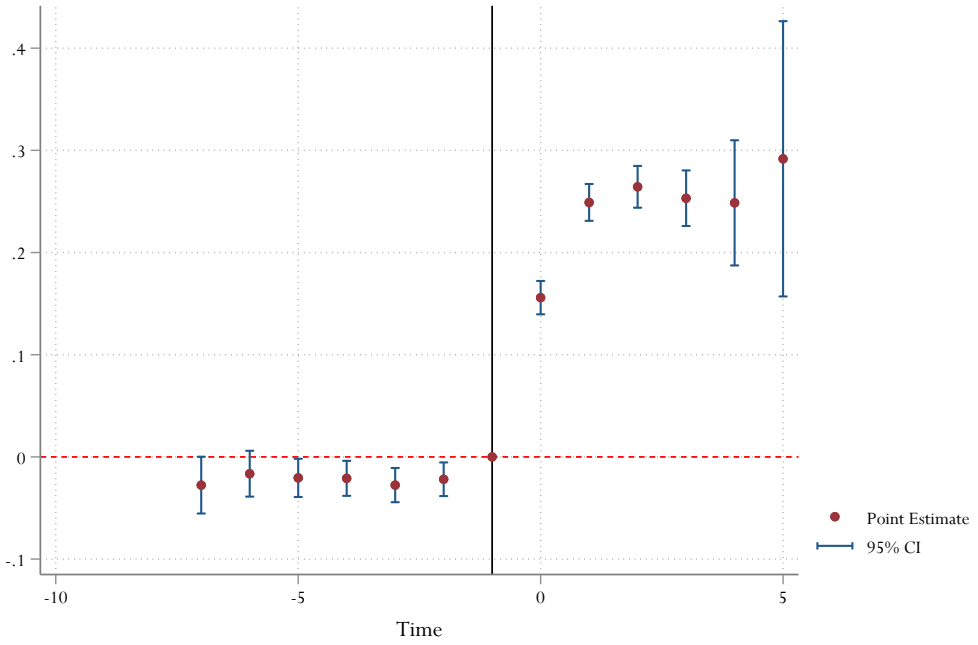
```
. _eststo bk9: xtreg bkfast_part i.bicpost i.year, fe
Fixed-effects (within) regression               Number of obs     =      8,061
Group variable: schoolid                        Number of groups  =      1,134
R-sq:                                           Obs per group:
     within  = 0.2795                                         min =          1
     between = 0.0598                                         avg =        7.1
     overall = 0.1148                                         max =          8
                                                F(8,6919)         =     335.58
corr(u_i, Xb)  = 0.0190                         Prob > F          =     0.0000
------------------------------------------------------------------------------
 bkfast_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   1.bicpost |   .2401689     .00519    46.28   0.000     .2299949     .250343
             |
        year |
       2006  |   .0044188   .0029947     1.48   0.140    -.0014517    .0102893
       2007  |    .014081   .0029934     4.70   0.000      .008213    .0199489
       2008  |   .0323786     .00299    10.83   0.000     .0265173    .0382398
       2009  |   .0323863    .002985    10.85   0.000     .0265348    .0382379
       2010  |   .0288188   .0029883     9.64   0.000     .0229607    .0346768
       2011  |   .0212334   .0029844     7.11   0.000     .0153832    .0270837
       2012  |   .0238968   .0030003     7.96   0.000     .0180154    .0297783
             |
       _cons |   .2310583   .0021406   107.94   0.000      .226862    .2352546
-------------+----------------------------------------------------------------
     sigma_u |  .13012765
     sigma_e |  .06530265
         rho |  .79882498   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(1133, 6919) = 24.77                 Prob > F = 0.0000
```

```
. _eststo bk10: xtreg bkfast_part i.bicpost i.year $covars i.year, fe
Fixed-effects (within) regression               Number of obs     =      8,060
Group variable: schoolid                        Number of groups  =      1,133
R-sq:                                           Obs per group:
     within  = 0.3063                                         min =          1
     between = 0.2030                                         avg =        7.1
     overall = 0.2492                                         max =          8
                                                F(17,6910)        =     179.44
corr(u_i, Xb)  = 0.0725                         Prob > F          =     0.0000
------------------------------------------------------------------------------
  bkfast_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    1.bicpost |   .2350494   .0051218    45.89   0.000     .2250091    .2450896
              |
         year |
        2006  |   .0017941   .0029722     0.60   0.546    -.0040323    .0076204
        2007  |   .0097984   .0030065     3.26   0.001     .0039047    .0156921
        2008  |   .0260502    .003113     8.37   0.000     .0199478    .0321525
        2009  |   .0266835   .0031765     8.40   0.000     .0204566    .0329105
        2010  |   .0227423   .0032784     6.94   0.000     .0163156    .0291689
        2011  |   .0158046   .0032591     4.85   0.000     .0094157    .0221935
        2012  |    .019164   .0032683     5.86   0.000     .0127572    .0255709
              |
       pctell |    .000486   .0003003     1.62   0.106    -.0001027    .0010748
      pctsped |  -.0000381   .0003498    -0.11   0.913    -.0007239    .0006476
totalenroll~t |    -.00011   8.92e-06   -12.34   0.000    -.0001275   -.0000926
     pctasian |   .0001814   .0004489     0.40   0.686    -.0006986    .0010614
     pctblack |   .0000463   .0003542     0.13   0.896    -.0006479    .0007406
      pcthisp |   .0004305   .0003458     1.24   0.213    -.0002475    .0011084
    pctfemale |  -.0006497   .0003751    -1.73   0.083     -.001385    .0000856
        free1 |   .0005287   .0001077     4.91   0.000     .0003177    .0007398
        redu1 |   .0010268   .0002649     3.88   0.000     .0005075     .001546
        _cons |    .266862   .0336824     7.92   0.000     .2008342    .3328898
--------------+---------------------------------------------------------------
      sigma_u |  .12007859
      sigma_e |   .0641221
          rho |  .77811493   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(1132, 6910) = 19.08                 Prob > F = 0.0000
.
```

```
. _eststo lu9: xtreg lunch_part i.bicpost i.year, fe
Fixed-effects (within) regression               Number of obs     =      7,790
Group variable: schoolid                        Number of groups  =      1,133
R-sq:                                           Obs per group:
     within  = 0.0273                                         min =          1
     between = 0.0002                                         avg =        6.9
     overall = 0.0024                                         max =          8
                                                F(8,6649)         =      23.34
corr(u_i, Xb)  = -0.0090                        Prob > F          =     0.0000
------------------------------------------------------------------------------
  lunch_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   1.bicpost |  -.0009558     .00547    -0.17   0.861    -.0116787    .0097671
             |
        year |
       2006  |   .0067058   .0031194     2.15   0.032     .0005909    .0128208
       2007  |   .0156171   .0031225     5.00   0.000      .009496    .0217383
       2008  |   .0241925   .0031449     7.69   0.000     .0180275    .0303574
       2009  |   .0248664   .0031515     7.89   0.000     .0186883    .0310444
       2010  |   .0109544   .0031018     3.53   0.000     .0048739    .0170348
       2011  |   .0036836   .0031059     1.19   0.236    -.0024049    .0097721
       2012  |   -.006695   .0031212    -2.14   0.032    -.0128136   -.0005764
             |
       _cons |   .7672743   .0022401   342.52   0.000      .762883    .7716657
-------------+----------------------------------------------------------------
     sigma_u |  .17353188
     sigma_e |  .06672362
         rho |   .8711993   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(1132, 6649) = 45.93                 Prob > F = 0.0000
```

```
. _eststo lu10: xtreg lunch_part i.bicpost i.year $covars i.year, fe
Fixed-effects (within) regression               Number of obs     =      7,789
Group variable: schoolid                        Number of groups  =      1,132
R-sq:                                           Obs per group:
     within  = 0.0871                                         min =          1
     between = 0.3086                                         avg =        6.9
     overall = 0.3043                                         max =          8
                                                F(17,6640)        =      37.29
corr(u_i, Xb)  = 0.0393                         Prob > F          =     0.0000
------------------------------------------------------------------------------
   lunch_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    1.bicpost |  -.0029236   .0053289    -0.55   0.583      -.01337    .0075228
              |
         year |
        2006  |   .0089807   .0030534     2.94   0.003      .002995    .0149663
        2007  |   .0175242   .0030951     5.66   0.000     .0114569    .0235915
        2008  |   .0263172   .0032315     8.14   0.000     .0199824     .032652
        2009  |   .0290393   .0033019     8.79   0.000     .0225665     .035512
        2010  |   .0167254    .003364     4.97   0.000     .0101309    .0233198
        2011  |   .0087284   .0033533     2.60   0.009     .0021548     .015302
        2012  |  -.0009017   .0033653    -0.27   0.789    -.0074989    .0056954
              |
       pctell |  -.0000423   .0003112    -0.14   0.892    -.0006523    .0005677
      pctsped |  -.0007749   .0003613    -2.14   0.032    -.0014831   -.0000667
totalenroll~t |  -.0000716   9.26e-06    -7.73   0.000    -.0000898   -.0000534
     pctasian |   .0035087   .0004558     7.70   0.000     .0026152    .0044023
     pctblack |   .0036064   .0003608    10.00   0.000     .0028992    .0043137
      pcthisp |   .0029797   .0003534     8.43   0.000      .002287    .0036725
    pctfemale |   -.001066   .0003854    -2.77   0.006    -.0018215   -.0003105
        free1 |   .0011112   .0001109    10.02   0.000     .0008939    .0013286
        redu1 |   .0014702   .0002697     5.45   0.000     .0009415    .0019988
        _cons |    .505751    .034375    14.71   0.000      .438365     .573137
--------------+---------------------------------------------------------------
      sigma_u |  .14439164
      sigma_e |  .06468285
          rho |  .83286454   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(1131, 6640) = 22.72                 Prob > F = 0.0000
.
.
. // ****
. // (1)
. // ****
. // Event study using eventdd
. // first find year of BIC implementation
. egen temp=min(year) if bicpost==1, by(schoolid)
(7784 missing values generated)
. egen bicevent=max(temp), by(schoolid)
(7147 missing values generated)
. drop temp timetoevent
. // Create new time to event variable based on when school adopted BIC
. gen timetoevent=year-bicevent if bicever==1
(7,147 missing values generated)
```

```
. _eststo bk11: eventdd bkfast_part $covars i.year, method(fe) timevar(timetoevent)
Fixed-effects (within) regression               Number of obs      =      8060
Group variable: schoolid                        Number of groups   =      1133
R-sq:  within  = 0.3146                         Obs per group: min =         1
       between = 0.2144                                        avg =       7.1
       overall = 0.2593                                        max =         8
                                                F(28,6899)         =    113.07
corr(u_i, Xb)  = 0.1057                         Prob > F           =    0.0000
------------------------------------------------------------------------------
  bkfast_part |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
       pctell |   .0003774   .0002991     1.26   0.207    -.0002088    .0009637
      pctsped |  -.0001068   .0003485    -0.31   0.759      -.00079    .0005763
totalenroll~t |  -.0001052   8.89e-06   -11.84   0.000    -.0001226   -.0000878
     pctasian |   .0003149   .0004469     0.70   0.481    -.0005612    .0011911
     pctblack |    .000163   .0003525     0.46   0.644    -.0005279    .0008539
      pcthisp |    .000336   .0003441     0.98   0.329    -.0003385    .0010105
    pctfemale |  -.0005987   .0003734    -1.60   0.109    -.0013306    .0001332
        free1 |   .0005431   .0001072     5.06   0.000     .0003329    .0007533
        redu1 |   .0009341   .0002637     3.54   0.000     .0004172     .001451
              |
         year |
        2006  |   .0019782   .0029875     0.66   0.508    -.0038783    .0078347
        2007  |   .0102962   .0030333     3.39   0.001     .0043499    .0162424
        2008  |   .0265696    .003145     8.45   0.000     .0204045    .0327348
        2009  |   .0280921    .003215     8.74   0.000     .0217897    .0343945
        2010  |    .023918   .0033084     7.23   0.000     .0174326    .0304035
        2011  |   .0139787   .0032913     4.25   0.000     .0075267    .0204306
        2012  |   .0124126   .0033166     3.74   0.000     .0059109    .0189142
              |
        lead7 |  -.0276096   .0141737    -1.95   0.051    -.0553944    .0001753
        lead6 |  -.0164351   .0114508    -1.44   0.151    -.0388821     .006012
        lead5 |  -.0205187   .0095438    -2.15   0.032    -.0392274   -.0018099
        lead4 |  -.0209752   .0087353    -2.40   0.016     -.038099   -.0038514
        lead3 |  -.0275767   .0085468    -3.23   0.001    -.0443311   -.0108223
        lead2 |  -.0218747   .0083968    -2.61   0.009     -.038335   -.0054145
         lag0 |   .1558723    .008323    18.73   0.000     .1395567    .1721878
         lag1 |   .2490285   .0091894    27.10   0.000     .2310145    .2670424
         lag2 |   .2642903   .0104183    25.37   0.000     .2438673    .2847133
         lag3 |   .2531332   .0138807    18.24   0.000     .2259227    .2803437
         lag4 |   .2485886   .0312343     7.96   0.000     .1873598    .3098173
         lag5 |   .2916986    .068707     4.25   0.000     .1570117    .4263855
        _cons |   .2637858   .0335307     7.87   0.000     .1980552    .3295163
--------------+---------------------------------------------------------------
      sigma_u |  .11963989
      sigma_e |  .06378841
          rho |  .77865225   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(1132, 6899) = 19.33                 Prob > F = 0.0000
. graph export partj.pdf, replace as(pdf)
(file partj.pdf written in PDF format)
```




```
.
.
. capture log close
```