**[Teachers’ Pay for Performance in the Long-Run: The Dynamic Pattern of Treatment Effects on Students’ Educational and Labor Market Outcomes in Adulthood](http://obs.rc.fas.harvard.edu/chetty/value_added.html" \t "_blank)**

**Victor Lavy**

University of Warwick and Hebrew University

Instructions for data and replication package (prepared by Peleg Samuels, completed October 2019).

**Documentation of Analysis and Reproduction Instructions**

***Introduction***

The document details the codes needed to generate the results in the study “[Teachers’ Pay for Performance in the Long-Run: The Dynamic Pattern of Treatment Effects on Students’ Educational and Labor Market Outcomes in Adulthood](http://obs.rc.fas.harvard.edu/chetty/value_added.html)”. It also explains which log files are relevant to which tables, and how they are used to create the tables. Finally, information is provided on how to replicate the results using the data attached to the appendix.

***Folders and Files Provided***

The root folder has four subfolders:

1. **Stata Code** – this folder contains the programs (.do files) that produce the tables and the sample-specific data files. Codes used to create the tables and figures in the manuscript are saved in a separate folder than those used in the creation of the appendix tables and figures.
2. **Results** – this folder contains the tables stored in MS-Excel format. These are Excel files saved by the codes automatically using the postfile command.
3. **Logs** – this folder contains the log files made by Stata for all tables, figures and the main data processing do file.
4. **Data –** this folder contains a single data set, which is used to reproduce all the results that are reproducible (please see below.)

***Data Structure***

There is one dataset that contains the necessary data.[[1]](#footnote-1) It is located at National Insurance Institute (NII) [which is the Israeli Social Security authority] lab, to which all researchers may apply for access. Direct access to the data files used in the study may be requested from the author. The file name is PublicationDataSet.dta. This file is “publication-ready”, as it was prepared for publication, in anticipation for authorization to release the data with publication. Its root folder is: “W:\victor\_lavi\Incoming\olim1\elior\Teachers Bonuses”.

This file was produced from the data provided by the NII administration, as detailed in the paper. The log file for the creation of the final data set, PublicationDataSet.dta, can be seen in the log file, under the name “DataSetCreationForPublication\_25Jul19.txt”

Please see below for details on the structure of the data.

However, some tables and figures require data from more years than is available in PublicationDataSet.dta. In preparation for publication, and following the NII policy, the core results of the paper were identified and the minimal data required to reproduce them was saved separately. Tables, table parts and figures that could not be reproduced using this data set are still reproduceable from the data at the Social Security lab.

At the NII lab, each relevant code runs through the needed data preparation (such as adjusting nominal values for inflation.) In the released data set of preparation PublicationDataSet.dta this has already been done. Codes that cannot be reproduced using PublicationDataSet.dta do **not** have the word “Replication” in their name. See below for details.

***Recreating the Tables***

All analyses were done in Stata. Some were automatically formatted to Excel (using the command ‘post’) while others rely on the written log file, manually formatted to a table. Some tables are created by two programs and some programs are relevant to more than one table (if certain regressions share a fundamental logic, such as stacking outcomes over the years they were done together.) The do file names identify the tables which they produce. A detailed list is also available below.

|  |  |  |  |
| --- | --- | --- | --- |
| Table | Description | Program File | Notes |
| 1 | Descriptive statistics and tests for balance between treatment and control school students in the pre-treatment cohort (2000) | “Replication T1.do” |  |
| 2 | Estimates of the effect of teachers' bonuses program on post-secondary schooling (12 years after high-school graduation) | “Replication T2 T4 T5 - Controlled.do” **AND** “Replication T2 T4 T5 - Uncontrolled” |  |
| 3 | Cross section estimates, post-secondary education outcomes 12 years after high-school graduation and labor market outcomes 11 years after high-school graduation, specification with controls | “Replication T3 2000 and 2001.do” **AND** “T3 1999 and 2002.do” | Partially not reproducible using PublicationDataSet.dta. See below. |
| 4 | Estimates of the effect of the teachers' bonuses program on employment and income | “Replication T2 T4 T5 - Controlled.do” **AND** “Replication T2 T4 T5 - Uncontrolled” **AND**  Replication T4 T5 Stacked (results in log) |  |
| 5 | Estimates of the effect of the teachers' bonuses program on percentile ranking of income | “Replication T2 T4 T5 - Controlled.do” **AND** “Replication T2 T4 T5 - Uncontrolled” **AND**  “Replication T4 T5 Stacked (results in log).do” |  |
| 6 | Estimates by family income and by gender, 11 years after high-school graduation for post-secondary schooling and 9-11 years after high-school graduation for stacked employment and income regressions (using the natural experiment sample) | “Replication T6 Education.do” **AND** “Replication T6 Employment Stacked (results in log).do” |  |
| 7 | Estimates, demographic outcomes 11 years after high-school graduation (using the natural experiment sample) | “Replication T7 (results in log).do” |  |
| A1 | Estimates from Regressions of the 1999 Measurement Error in the School Matriculation Rate on the 2001 Student and School Characteristics | A1 is cited from a previous paper |  |
| A2 | Treatment-Control Differences in Employment and Income Outcomes (11 Years After High-School Graduation), Within Pre (2000) and Post (2001) Treatment Cohorts, With and Without Controlling for School Type, using the Natural Experiment and the Regression Discontinuity Samples | “Replication T2A.do” |  |
| A3 | Differences-in-Differences Estimates of the Effect of Teachers' Bonuses Program on High School Education Outcomes | “T3A - Controlled – BTL.do” **AND** “T3A - Controlled – Falk.do” | partially run on data from the Social Security lab (abbreviate in Hebrew BTL) and partly from education data from the Falk institute (on which the first paper was based.) As such, there are two codes, each running on the relevant data.  Not reproducible using PublicationDataSet.dta. See code. |
| A4 | DID Estimates of the Effect of Teachers' Bonuses Program on Post-Secondary Schooling with Wild Bootstrap Standard Errors (12 Years After High-School Graduation) | “T4A\_8A bootstrap Genia NE.do” **AND** “T4A\_8A bootstrap Genia RD.do” |  |
| A5 | Robustness Check - Post-Secondary Schooling, RD Sample With Alternative Bandwidth)  (12 Years After High-School Graduation Outcomes) | “Replication T5A\_11A.do” **AND** “T5A\_11A.do” |  |
| A6 | Placebo Tests, DID Estimates, Post-Secondary Schooling - Natural Experiment Sample (12 Years After High-School Graduation) | “T6A\_10A1999.do” **AND** “T6A\_10A2002.do” | Not reproduceable using PublicationDataSet.dta. See code. |
| A7 | DID Estimates of the Effect of Teachers' Bonuses Program on Post-Secondary Schooling - Treatment Allocated to Schools Randomly Within The Natural Experiment Sample  (12 Years After High-School Graduation) | “T7A\_9A Not Stacked.do” | Not reproduceable using PublicationDataSet.dta. See code. |
| A8 | DID Estimates of the Effect of The Teachers' Bonuses Program on Employment and Income with Wild Bootstrap Standard Error | “T4A\_8A bootstrap Genia NE.do” **AND** “T4A\_8A bootstrap Genia RD.do” |  |
| A9 | DID Estimates of the Effect of Teachers' Bonuses Program on Employment and Earnings - Treatment Allocated to Schools Randomly Within The Natural Experiment Sample (12 Years After High-School Graduation) | “T7A\_9A Not Stacked.do” **AND** “T9A Stacked.do” | Not reproduceable using PublicationDataSet.dta. See code. |
| A10 | Placebo Tests, DID Estimates, Employment and Earnings, Natural Experiment Sample (12 Years After High-School Graduation) | “T6A\_10A1999.do” **AND** “T6A\_10A2002.do” | Not reproduceable using PublicationDataSet.dta. See code. |
| A11 | Robustness Check - Employment and Earnings, RD Sample With Alternative Bandwidth)  (11 Years After High-School Graduation Outcomes) | “Replication T5A\_11A.do” **AND** “T5A\_11A.do” |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Figure | Description | Program File | Notes |
| 1 | Mean and treatment effect: university enrollment (natural experiment sample) | “Dynamic Graphs.do” |  |
| 1A | Mean and treatment effect: university years of schooling (natural experiment sample) | “Dynamic Graphs.do” |  |
| 2 | Mean and treatment effect: college enrollment (natural experiment sample) | “Dynamic Graphs.do” |  |
| 2A | Mean and treatment effect: college years of schooling (natural experiment sample) | “Dynamic Graphs.do” |  |
| 3 | Mean and treatment effect: employment rate (natural experiment sample) | “Dynamic Graphs.do” |  |
| 4 | Mean and treatment effect: annual earnings, prices in 2009 NIS (natural experiment sample) | “Dynamic Graphs.do” |  |
| 5 | Mean and treatment effect: annual earnings by gender, prices in 2009 NIS (natural experiment sample) | “Dynamic Graphs - Figure 5 (by gender).do” |  |
| 6A | McCrary plots | “McCrary - F6A.do” | This code creates multiple McCrary plots, only some of which are presented in the appendix and discussed. |

Results and log files from reproducible tables are provided as one should expect to receive when correctly reproducing the results (that is, **using the provided data, and not at the NII lab**.) Results and logs that are not reproducible appear “as is” from the NII lab.

***Results and figures***

Results that are automatically saved in Excel formatת in the folder “Intermediate results file”. The names are as the code, with suffixes for samples. For example, the name “Table\_T3\_cross\_sections\_1999\_2002\_NE” holds the results for table T3, and includes the cross sections for the years 1999 and 2002 for the **Natural Experiment** sample. The name “{T6A\_T10A\_2002\_}\_NE\_q4” refers to the results for tables T6A and T10A for 2002, for the natural experiment sample, for all four quarters of the sample.

Figures are saved both in PDF and EPS format. They are also saved with and without title. Main manuscript figures are in the “Figures” folder, and appendix figures are in the “Appendix plots” folder.

***Reproduction instructions***

The data attached in the appendix, “PublicationDataSet.dta”, allows for reproduction of the main results of the paper. However, it does not allow reproduction of all results, and particularly none of the figures are reproducible. This is due to constraints placed by the National Insurance Institute (NII) in Israel (the Israeli Social Security administration).

The full results are reproducible at the NII’s research lab in Jerusalem, to which any researcher can apply for access (we are not aware of any accredited researcher denied such access). If one were to attempt to use the data in the NII’s research lab, it is greatly advised that he consult with the author first, so that he receives the same raw data, and manipulate it in the same way.

Within the program files you will find satisfactory comments.

However, note that some code segments were commented out. These are remains from previous iterations of the code, and were kept to guide the user on alternative ways to run the code.

Before running any of the files, it is important to change the **cd** line in every code you use. Set it to the root folder to which you extracted the files (the one under which the data, logs, and results folders exist).

What is NOT reproducible – and why

The following is a list of tables and figures that are fully or partially **not** reproducible:

Tables:

1. Table 3 – columns 1, 4, 5, and 8
2. Table 1A
3. Table 3A
4. Table 6A
5. Table 10A
6. All figures

Aside from tables 1A and 3A, the reason all other tables and figures are not reproducible is the same: we were unable to export data that included observations on individuals for more than 3 years. We chose to include for each observed individual the 10th, 11th, and 12th years after graduation outcomes, as this allows reproduction of all main results. However, this means that any statistics calculated for the 1999 or 2002 cohorts are not fully covered by these years. That is why Table 3’s columns that detail these years cannot be reproduced. Similarly, tables 6A and 10A run placebo tests on these exact cohorts. As such, they too are not fully covered by the data.

The figures are the most data-intensive, and require the data from all years after high school graduation. That is clearly impossible with the data we were able to export.

Table 1A is not included as it appeared in a previous article by the author, and we refer the reader to it:

LAVY, V. (2009), “Performance Pay and Teachers’ Effort, Productivity and Grading Ethics”, *American Economic Review*, **99** (5), 1979-2011.

Table 3A uses data from the Education ministry, and we were unable to authorize its publication, and in particular – linking it to the data from the NII.

Guide to replication of results using provided data

To run the codes, the user will require four things:

1. Stata 14
2. A set of folders from which to read the data, and to which to write logs and result files. The user should have a single directory for reproduction. Underneath it, he should have three folders, named exactly as follows:
   1. “data” – this folder houses the “PublicationDataSet.dta” file
   2. “logs” – to which logs will be written
   3. “results” – to which results in Microsoft Excel format will be written
      1. Beneath the results folder there should be a folder named “automatic”.

The **cd** command in each program should direct to the root of these folders.

1. The data set, “PublicationDataSet.dta”, placed in the “data” folder described above, and available in this appendix.
2. The package boottest, which can be downloaded with the command “ssc install boottest” from within Stata.

See documentation here: <https://ideas.repec.org/c/boc/bocode/s458121.html>

This is only relevant for tables 4A and 8A.

Data

The data for publication is a curated version of the data originally used for the production of the tables. In particular, only 3 years of outcomes were selected for each student, and those variables’ names were changed so that the new data set was intuitive and made sense. The three years were selected so that each outcome would be observed 9, 10, and 11 years after graduation.

Aside from that, the NII scrambled the school codes and removed the Student ID (which is available at the NII lab), for obvious reasons. Some of the variables were renamed after exportation, to conform with the names in the do codes (in particular, the NII changed all variable names to lower case, and this was reversed).

The user is advised to go over the code “DataForPublication.do” and the log “DataSetCreationForPublication\_25Jul19” used to curate the data from the full data set, as described above.

The dataset includes 13,348 observations. There are a few key variables, discussed below (for the economic meaning or justification of each variable see manuscript text):

*Sample variables:*

These are dummy variables that indicate whether individuals should be included in two samples used in the empirical work of this paper: the natural experiment sample, and the regression discontinuity samples:

* NE=1 if included in the natural sample;
* RD=1 if included in the main regression discontinuity sample;
* RD\_alternative1=1 for sample relevant to RD with grade cutoff 0.37-0.4 (treatment) and 0.52-0.54 (control);
* RD\_alternative2=1 for grade cutoff 0.38-0.4 (treatment) and 0.52-0.53 (control).

The same student may appear multiple times for different samples – **always select a sample**.

*Potential Outcome framework dummies*

after, afterXtreatment, treatment are dummy variables for the DID framework – each relevant for its own sample. The “treatment” dummy is usually omitted when there are school fixed effects in the regression.

*Control variables:*

**-** hoodWeight – frequency weight to compare observations from different schools – see text.

- boy – sex dummy (1=men)

- m\_ahim – number of siblings

- educav – father’s years of education

- educem – mother’s years of education

- ole – immigrant dummy (1=immigrant)

- euram – Europe/North America origin dummy

- asiafr – Asia/Africa origin dummy

- e\_awr\_lgcr –total English credit units awarded (lagged – see text)

- att\_lgcr –total English credit units attempted (lagged – see text)

- awr\_lgcr –total credit units awarded (lagged – see text)

- att\_lgsc – average score among credit units attempted (lagged – see text)

- schtype – school type (Jewish secular, Jewish religious, Non-Jewish)

- av\_avwage00\_02 - Father’s average wage 2000-2002

- em\_avwage00\_02 - Mother’s average wage 2000-2002

- house\_avwage00\_02 – Household average wage 2000-2002

- house\_avwage00\_02H – dummy of whether household was above median income (see text)

- house\_avwage00\_02L – dummy of whether household was below median income (see text)

- q4 – equals 1 for all observations

- q3 – equals 1 for top three quartiles. Not used in current iterations of paper but provided for user’s own analyses.

*Outcome variables*

Outcome variables are self-explanatory, and follow a template, which is NAME\_X\_afterSchool. NAME indicates the type of outcome (for example, wages) and X is the number of years after high school graduation. Some outcomes are only observed once, such as marriage or fertility. These outcomes do not have the “X\_afterSchool” in their names.

A few notable outcomes (usually involve Hebrew in the name)

- yeladim – number of children (As opposed to the variable “kids” which is a dummy variable for having kids)

- avt\_X\_afterSchool – dummy variable for whether individual received unemployment benefits X years after high school graduation

- avt\_tot\_X\_afterSchool– total received unemployment benefits X years after graduation

(avt is short for Avtala, which translates to unemployment)

- pctl\_wage\_X\_afterSchool – percentile rank of wage income X years after graduation.

*Other variables*

**-** school\_code – school code, not-relatable to any other code used for the school (scrambled by NII to protect identity – cannot be used to merge outside data.)

- school\_codeYear – a unique cohort code, can be reconstructed from school\_code and year.

Main table do files

Codes are ordered by the type of regression being ran, and not by table. In some cases, this coincides with a single table. Tables 1, 3 (the reproducible part), and 7 are such tables. The controlled regressions of table 2,4 and 5 are run by a single code, separately from the uncontrolled versions of the same regressions (which are all in one do file as well).

The stacked version of these regressions (for tables 4 and 5) is run in its own do file, ‘Replication T4 T5 Stacked’. This do file runs both controlled and uncontrolled stacked regressions (our apologies for any possible confusion this may cause.)

The overall do files are relatively simple. Some use loops to execute a series of regressions analyses (usually by looping through the outcome variable, though not always;) while others manually run the relevant regressions. This combination may seem arbitrary to the reader, and we ask for her patience.

1. Save for a part of table 3A, the McCreary figures, are based on data from the Education Ministry ; and table 1A, which is copied verbatim from a previous paper, see below and that paper for reproduction instructions. [↑](#footnote-ref-1)